THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

Vol. XXXI. No. 767.] LONDON, JANUARY 22, 1878. [30th Year.] Price 6d.

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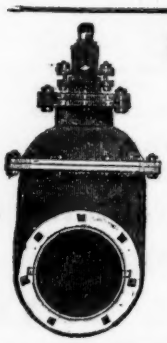

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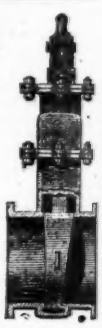

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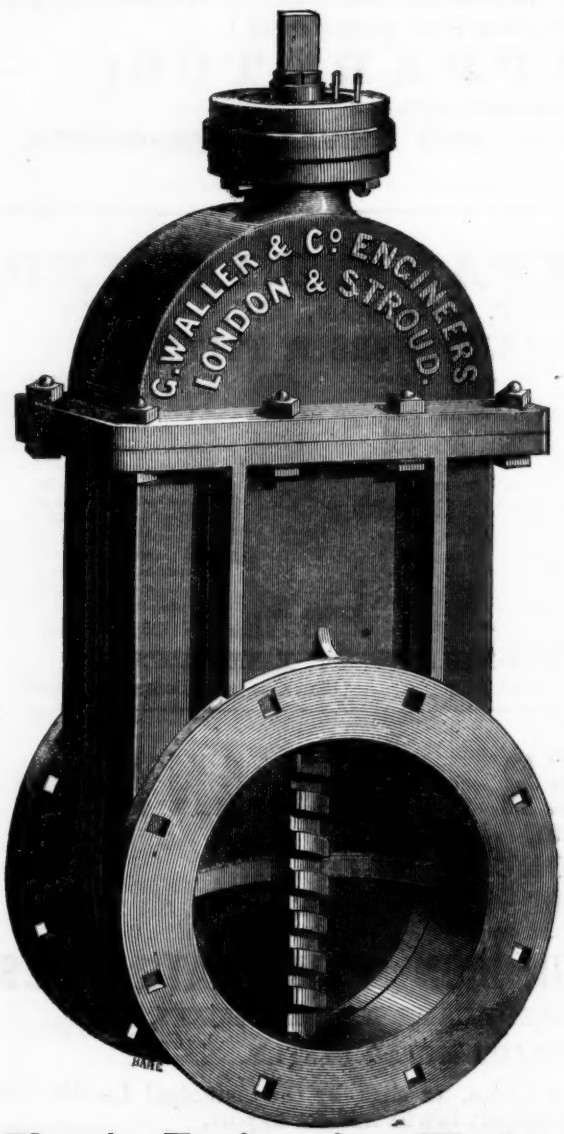

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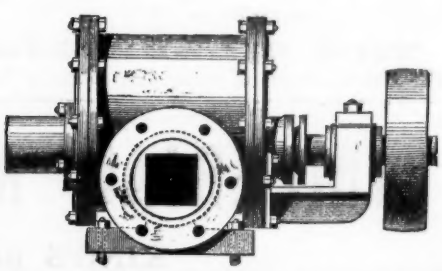

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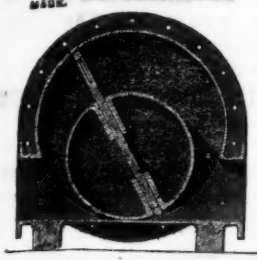

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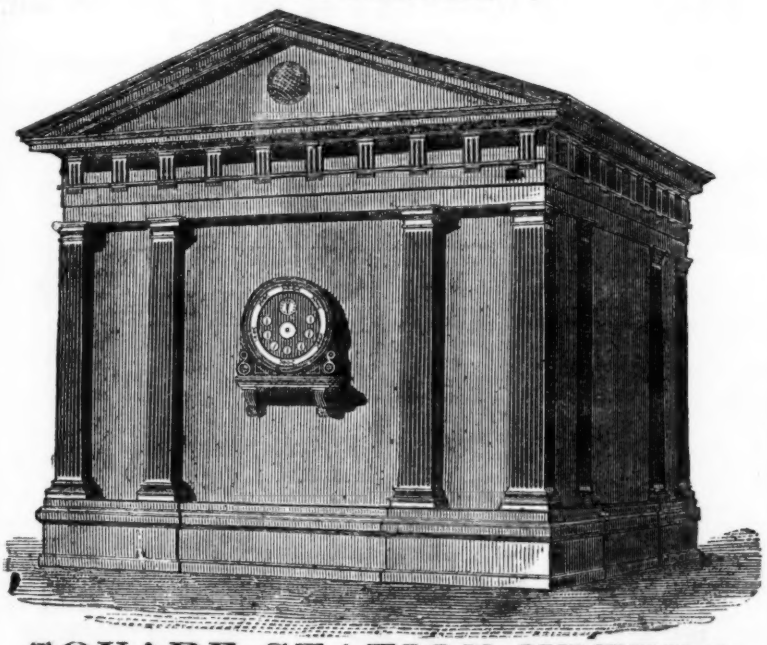

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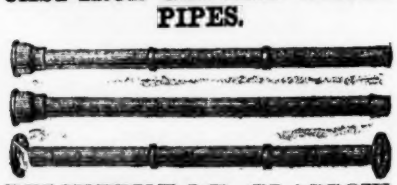

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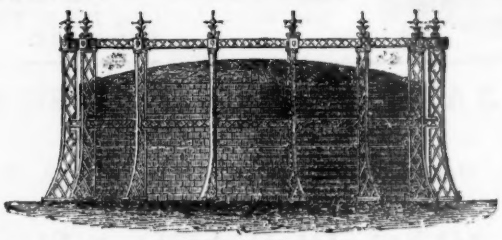

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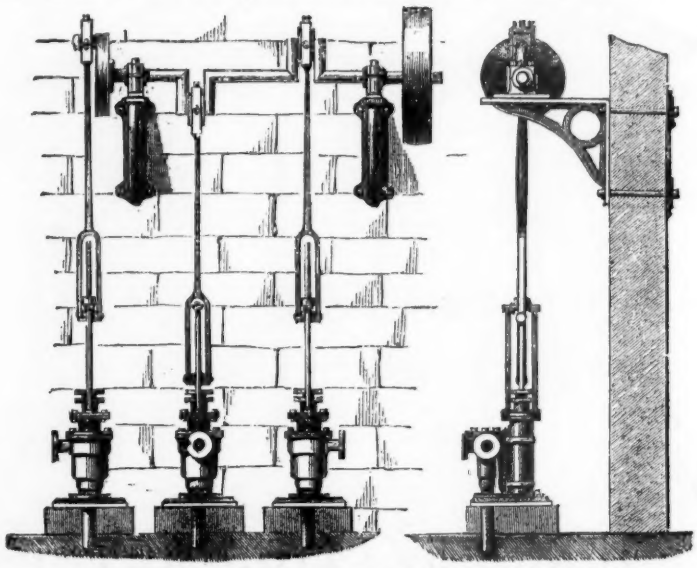

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For Water. For Tar. For Ammoniacal Liquor.
This illustration shows an arrangement of three (No. 179) Improved Double-Action Pumps driven from the same crank-shaft, as frequently supplied for use in Gas and Chemical Works. The suction and discharge pipes can be arranged for drawing from and delivering in any required direction.
These Pumps have been supplied to nearly all the large Gas Companies and Chemical Works, both for Pumping Water, Tar, and Ammoniacal Liquor.
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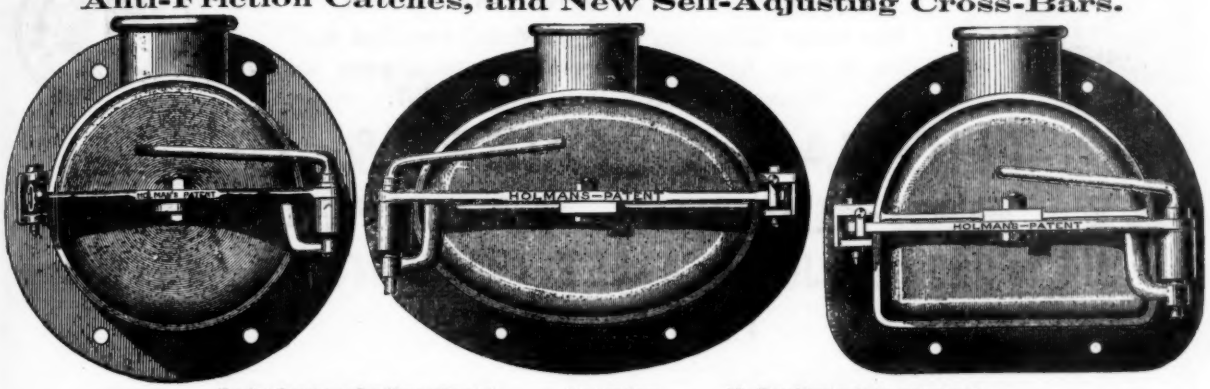
SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and New Self-Adjusting Cross-Bars.



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Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested, being now in use in nearly all the principal Gas-Works in London and the Provinces.

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D and Oval Morton's Lids are working satisfactorily both in this country, on the Continent, and in the United States of America. Among others they have been adopted by the following Gas-Works:—

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And also in the Gas-Works at Richmond, Maidstone, Gloucester, Glasgow, Portsea, Roubaix (France), The Hague (Holland).

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In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

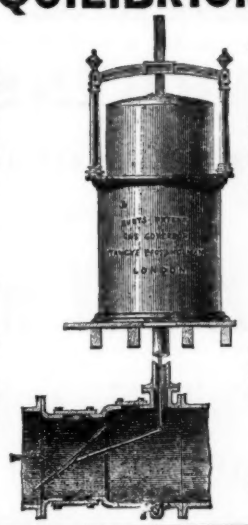
Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at any convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.



These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,

(Signed) JOHN JOHNSON.

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Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
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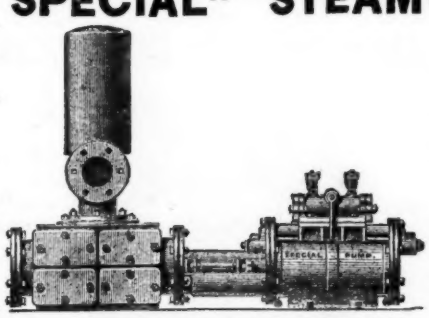
4	2	9	815	18
5*	2½	12	1,250*	20
5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
5	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,350*	50
7	7	12	9,750	50
10*	7	12	9,750*	65



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Two Hundred Sizes made. Those in Table opposite are the leading Sizes for use in Gas-Works and Chemical Works.

* These Sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance-piece between steam and pump cylinder, at a small extra cost.

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PATENT DRY GAS-METERS,

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Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

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3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
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9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

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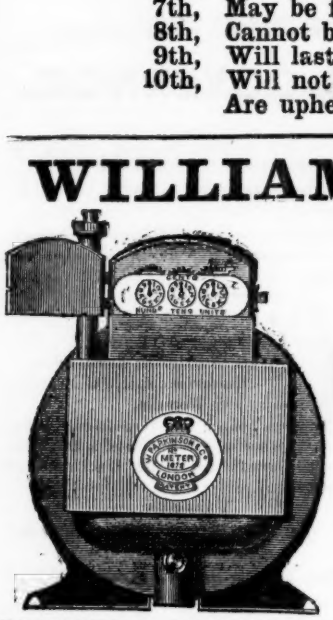

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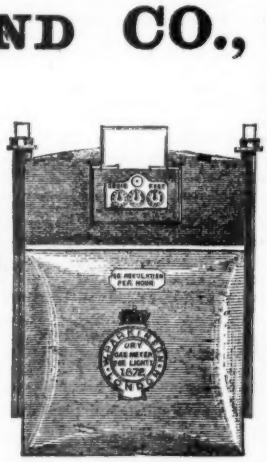

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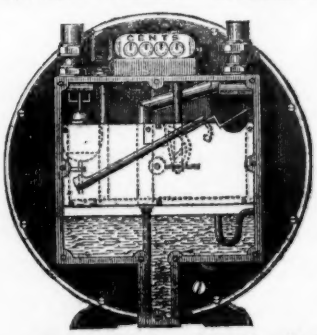

The Meter has been critically tested, and most favourably reported upon by official Meter Inspectors in London and Birmingham.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 22, 1878.

Circular to Gas Companies.

THE rage for the purchase of gas undertakings by Local Authorities still continues unabated. In the present session of Parliament, ten Bills are promoted either to effect compulsory purchases, or to confirm agreements already entered into. In most cases the terms and considerations have been arranged between the two parties, and the Bills will pass into Acts, as a matter of course. In one or two, however, severe parliamentary contests may be anticipated. The two principal purchases for which confirmation is sought are Leicester and Limerick. In the former instance, terms, which might almost be deemed liberal, have been settled between the Directors of the Company and the Corporation. In the Limerick case, the terms of purchase are also settled, and no opposition is likely to be raised to the passing of the Act, which will transfer to the Limerick Corporation the last undertaking of the United General Company.

The Town Council of Bangor and the Gas Company are hopelessly at variance as to the value of the gas undertaking. We may assume that the Corporation will proceed with their Bill to effect a compulsory purchase, and we may anticipate a strong contest before the Committee. The decision in this case will show us how far Parliament are disposed to lend themselves to the cant of the day, which preaches that gas and water, being necessaries of life, should be supplied by Local Authorities. Last session Compulsory Purchase Bills were not particularly successful. Much as we object to the possession of commercial undertakings by Local Authorities, there is nothing to be said against it when the transfer is obtained by fair means, and on equitable terms. We entertain, however, the strongest prejudice against compulsory purchases. The only gratifying fact connected with them is that, in the few cases which have happened, the Companies have obtained a liberal consideration for their property, and if the Bangor Company can give any proof that the value of their undertaking is what they represent it, we believe they may safely rely upon the justice of a Parliamentary Committee to reject a Compulsory Purchase Bill, or to secure them the terms they ask.

The transfer of the undertaking of the Newbury Gas Company to the Corporation will be effected under very peculiar circumstances, which do not often occur in this country. It seems that the Company erected their works on lands belonging to the Corporation, of which they obtained a lease, which expires this year; and they agreed, at the expiration, to sell the undertaking on a valuation, without reference to the business attached thereto. The bargain was a very bad one; but the Company must stand by it. We only hope that in the course of the fourteen years in which the Company have been in existence, the Shareholders have received good dividends. They will now get expended capital back, *minus*, possibly, a considerable sum for depreciation of plant. The case may, however, go to arbitration, and perhaps the Company may secure good terms. Fourteen years is far too short a period for a concession of this kind to endure. We do not remember any Continental City in which so short a period has been fixed. A case of the kind is not likely to occur again; but if it should, we recommend the Gas Company not to accept anything less than a twenty-five years lease.

The Newry Gas Bill is intended to effect a compulsory purchase of the Newry Gas Company, who are accused in the preamble of failing to adequately supply the town and neighbourhood. Of course, if this charge be substantiated, the Company can have no defence against their confiscation, but we always read preambles of Bills with a certain amount of suspicion, and we hope the Newry Company may be able to rebut the charge brought against them, "that their arrangements for the supply "of gas to the town of Newry and its neighbourhood are inade-"quate and unsatisfactory, and much inconvenience is thereby "occasioned to the inhabitants."

The West Houghton Local Board cannot come to terms with the West Houghton Gas Company, and unless arrangements are made in the interim, there will be another small parliamentary contest. But for the fact that the matter involves a great principle, it would be unworthy of notice. As, however, the Local Board are attempting to make a compulsory purchase, the case is of interest, and we shall watch the proceedings with care. The case will probably go to arbitration.

Next week we shall begin our usual abstract of the Bills to be presented this year. But, so far as a cursory glance over these documents enables us to judge, the present session will be a dull one, so far as gas legislation is concerned. The only burning questions likely to arise we have referred to above. The Bills for the incorporation of Companies, and for conferring further powers on Companies already incorporated, will, we may anticipate—except in a very few instances—be passed without opposition. The Bills promoted by Municipal bodies for extension of works, and for borrowing powers for the purpose, pass, as a matter of course; so that the Committee work of the year, in relation to gas matters, will probably be very light. Our columns will suffer accordingly, but they will probably be filled by endless discussions on water questions.

We do not know Whitwood, but it appears at the present time that the district is partially supplied with gas from the private undertaking of Messrs. Briggs and Co., with which the inhabitants seem perfectly satisfied. Three other parties will, however, in the present session, contend for the honour of illuminating the district. There are, for instance, the Local Board of the neighbouring district of Castleford, who are seeking power to borrow money for the erection of new works for the supply of

their own district and that of Whitwood as well; there are the Castleford and Whitwood Gas Company, Limited, who are seeking incorporation, with power to supply Whitwood; and then there are also the Normanton Gas and Water Company, who are seeking incorporation, with power to supply Whitwood with the former commodity. At a meeting of the ratepayers of Whitwood it was resolved almost unanimously to oppose the Bills of the Castleford Local Board and the Normanton Gas and Water Company. Thus the Bill of the Castleford and Whitwood Gas Company obtains an indirect support, while Messrs. Briggs and Co. are left in possession of the ground they occupy. The vote at the ratepayers meeting will apparently sanction the expenditure of money in opposing the two Bills mentioned above. Whitwood is evidently not in love with its neighbouring Board, and we shall be glad if their disunion result in the success of the Gas Company.

Featherstone loves darkness rather than light. There are gas-mains running through portions of the district; but the Local Board will not put up public lamps. There is a detestation of rates at Featherstone as well as elsewhere, and failing the power to inflict a special rate on the particular district interested, the Board have resolved to leave it in darkness.

Vague accusations against Gas Companies are too common, and are frequently brought against Corporations also having gas undertakings. We can easily believe that the Corporation of Leeds have not bestowed all the enterprise they might in replacing the small mains of the Companies with others, larger and better adapted to supply the needs of the day; but those who complain of a deficient supply of gas should have a little patience. The Corporation and their Manager, we are convinced, are doing their best, and, in good time, all grounds of complaint, if any really exist, will be removed.

The Bill of the Farnworth and Kearsley Gas Company may possibly be opposed by the Local Authority of the district. Most ridiculous complaints are made by men who, if the results of the consumption of gas on their premises be true, must have stuffy workshops and ill-ventilated houses. The worst gas ever made in the early days of gas lighting could not produce the effects which some members of the Farnworth Local Board allege to ensue from the combustion of that now supplied in the district of the Company. The joke is that in the early days of gas lighting, when scarcely any means of purification were resorted to, no complaints were made. It is only in these days, when quacks are prevalent, that Gas Companies are harassed by incessant grumblings about the quality of the article supplied so regularly and so cheaply.

The Commercial Gas Company are running the risk of still further persecution. They are depositing foul lime on the soil around the Bromley works, and an Inspector of Factories complains that the emanations from it are offensive and injurious to health. What an Inspector of Factories has to do with it we do not exactly understand; but, as he appears to be backed up by a Medical Officer of Health, we suppose there is some odour to be complained of. The remedy to be applied is a very simple one, and only involves a little labour. The fresh-fouled material, as it is shot out, has only to be covered up with an inch or two of weathered lime, and all stench will be prevented. Fouled lime oxidizes with extreme rapidity, and in a few hours offence is removed. We have seen a mountain of lime treated as we have mentioned almost in the heart of a town, and no complaints have been made.

We publish, according to promise, the Inaugural Address delivered by Mr. C. Hunt to the members of the Midland Association of Gas Managers. It will be found, as we have intimated, of considerable interest. We are glad to see that Mr. Hunt fully recognizes the claims of the parent body—the British Association of Gas Managers. The only objection we can reasonably bring against these Provincial Associations is, that they may possibly tend, we can hardly say to damage the interest, but, if we may be allowed a vulgarism, to take "the shine" out of the proceedings of the parent Association. Members cannot bring novel suggestions to the two Institutions, and the impression is forced upon us that every communication to a Local Association is, to a certain extent, a deprivation to the British meeting. Much has still to be done in perfecting both the manufacture and the purification of gas, and Gas Managers cannot too often meet together and compare notes on new methods of procedure. We quite agree with Mr. Hunt in the remarks he makes on carbonization. We firmly believe that heavy charges and long heats are a mistake, but then comes the labour question. In some form or other, mechanical stoking must come to our aid. The Foulis machine is an admirable one, but, in our ignorance, we believe it would be better if worked with compressed air instead of water. Mr. West's machine, simple and inexpensive as it is, is only adapted for use in comparatively small works. Both these machines, and probably others, which may or may not be improvements, will eventually find their way into use with advantage. As regards purification, we again agree with Mr. Hunt in thinking that the products of the distillation of coal are quite sufficient for the purification of the gas evolved. We have the purifying material, ammonia, in abundance, and it only remains to be settled in what manner it can be employed to the best advantage. There is, of course, the question whether it is financially more advantageous to a Gas Company to employ ammonia over and over again as a purifying agent, or to convert it at once into sulphate of ammonia, and sell it to a farmer. But no such question can arise in the Metropolis, where purification is rigidly insisted upon. Mr. Hunt is perfectly right in asserting that the principal object of a Gas Manager should be to cheapen production, but something more is required. He should at the same time aim at procuring gas of an increased illuminating power. Here in London, for instance, we are now threatened with an agitation for eighteen instead of sixteen candle gas, to be supplied at the price charged for sixteen. At the present time, the thing is impossible; but we will not say that cheap coals and improved manufacturing methods might not make the demand reasonable. What we wish to particularly impress on Corporations and Companies is, that they should give their Managers latitude for experimentation. A few hundred pounds spent on trials need not affect a dividend or increase the rates.

In another column will be found a short report of the visit paid by a party of gentlemen to the oil gas manufactory of Messrs. Pintsch and Co., Stratford. It turns out that this exhibition was preliminary to the issue of a prospectus, announcing the formation of a Limited Liability Company to take over the business of the firm mentioned, so far as England, India, and the English Colonies are concerned. The merits of the system cannot be doubted; but we rather think the value of the light is somewhat exaggerated. Compared with oil-lamps, the light is certainly more brilliant, and cheaper, while a vast amount of labour is dispensed with. We, of course, express no opinion on the terms of purchase which are proposed. For some reason or other, English Railway Companies, for the time, decline to adopt the system. The example of the Great Eastern Company may, however, soon be followed by others, and then the newly-formed Company may do a very remunerative business. At present we cannot say that we are perfectly satisfied with the light. A larger burner, we think, should be used, and a manufacturing station arranged at each terminus. It must be admitted, however, that it possesses great advantages. It differs but little from the system in use on the Reading and Philadelphia Railway, of which we propose, in a week or two, to give our readers plans and a description.

Water and Sanitary Notes.

Sir J. M. Hogg has lost no time in introducing the Metropolitan Water (Purchase) Bill, which was read the first time on Friday evening last, and referred to the Examiners. The companion measure is necessarily left for the moment in abeyance, and it may be that we shall hear nothing more of it. The two Bills ought, however, to go before the same Committee.

The Government, we may expect, will on this question observe a strict neutrality, and thus the Bills will be left to take their chance with the numerous other measures which have so early been brought forward. It is probable, however, that a second reading will not be long delayed, and, if an adverse division be not arrived at on that second reading, the great fight before a Select Committee will soon commence. That the Metropolitan Water Companies will make a stout resistance to their confiscation is certain, and opposition to the Purchase Bill is likely to spring up from other quarters. As regards the second Bill, for furnishing an independent supply of water for potable purposes and the extinguishing of fires, it may be expected a very powerful opposition will be organized. There is a strong opinion in the Metropolis that the supply is not needed, that it would prove very costly, and that it would produce an immense amount of discomfort in the Metropolis for several years. Meantime, opposition is springing up outside the Metropolis. The Local Board of Uxbridge have taken alarm at a proposal of the Metropolitan Board to sink at Denham and Hayes wells, which it is supposed may have the effect of draining the Uxbridge wells, and a meeting of ratepayers has sanctioned the expenditure of the money necessary for opposing this scheme. It was, however, cautiously recommended that, before engaging in active opposition, the Uxbridge Local Board should consult with the Metropolitan Board, and

endeavour to arrive at some amicable arrangement for the protection of the water supply, and for the interest of the district. If we suppose the scheme to be carried out, the Metropolitan Board could easily give compensation water to the Uxbridge Authority; but the success of the scheme is so improbable that we need not speculate on what would be necessary if the Uxbridge wells were drained.

The broader question, as to whether the Metropolitan Board are a body who can be safely trusted with the water supply of London, is sure to be raised, and will, we believe, be answered in the negative. The conduct of the vast business connected with the water supply of the Metropolis would be altogether beyond the limited ability of the forty-six gentlemen who are even now overburdened with work. The amount of labour required from a small Committee, to do the business now transacted by eight Boards of Directors, would be simply enormous, and utterly beyond the means of gentlemen who, besides conducting public affairs, have to earn their own livings. A differently constituted Board, or a Metropolitan Municipal Council, might better cope with the difficulties, and we anticipate that, to one or the other of these, the vexed water question will eventually be relegated.

The Annual Report of Captain Shaw, the Superintendent of the Fire Brigade, was presented at the meeting of the Metropolitan Board on Friday last. It gives the total number of fires at 1533. For the extinguishment of these, it is reported—but it can be little better than a guess—that but fourteen and a half million gallons of water were required, only half of which was drawn from the mains of the Water Companies. Seven millions of gallons only represents about one-seventeenth of the daily supply furnished by the Water Companies, and, therefore, it is absurd to assert that the resources of the Companies are not adequate to supply water sufficient for the extinguishing of fires. Deficiency of water, it is stated, occurred only in nine cases. Late attendance of turncocks is reported to have happened in thirty-three cases. As regards these, it must be said that the Metropolitan Board are entirely responsible for them. The Water Companies offered to lodge the turncocks at the Fire Brigade stations, and to pay for their lodgings; but the Board would not allow it.

We are much astonished that no mention of hydrants is made in Captain Shaw's report. Those fixed in the City of London have already proved of great efficiency. The City of London will, in a comparatively short time, be completely furnished with hydrants, provided with all necessary adjustments, and a much longer time cannot elapse before the whole Metropolis is supplied with them, the Metropolitan Board notwithstanding.

The Social Science Association have occupied themselves with the Metropolian Water Question, and in another column will be found a very interesting paper on the subject read by Mr. Lewis Angell. The discussion which followed shows that the scheme of the Metropolitan Board finds but little favour. We were, however, somewhat astonished to see the almost-forgotten Bagshot Sands scheme revived, and put forward as a substitute for the deep well scheme proposed by the Engineers consulted by the Metropolitan Board. The opinion of the meeting, too, seemed adverse to endowing the Metropolitan Board with the control of the water supply, and in general appeared in favour of the continued existence of the Companies. Mr. Edwin Chadwick, C.B., has, of course, no sympathies in common with the Metropolitan Board. He would naturally desire to see the administration of the water supply in the hands of three paid Commissioners and a Secretary, and we really should not be surprised if some plan of the sort were adopted. We shall not prophesy, however; time is passing away, and although we do not expect to see the Metropolitan Water Question settled this session, we shall, before long, know enough of the opinions of Parliament to enable us to make a shrewd guess as to what will be the ultimate solution.

The Manchester Corporation are adopting the tactics of the Corporation of the City of London, and have sent a begging letter to all the other Corporations in the kingdom, asking them to support Municipal rights, and petition in favour of the Thirlmere Scheme, which Manchester supposes to be endangered by the threatened opposition. This is pure nonsense, and the proceeding is very undignified. The scheme must rest on its own merits. Manchester wants water, and must have it from some source or other; and when the Corporation decide that Thirlmere is the best source to have recourse to, they have only to push forward their project with all the strength they possess. Petitions from all the little boroughs in the kingdom will not help them in the least.

Notice of motion has been given by Mr. E. Howard, the Member for East Cumberland, to the following effect:—"Select Committee to inquire into the supply of water to the manufacturing districts of Lancashire and the West of Yorkshire, and any deficiencies likely to arise therein; and whether it is necessary or expedient to resort to the Westmoreland and Cumberland Lakes to make good any deficiencies in such supply; and if so, to what extent, and under what conditions such resort should be sanctioned." The terms of this motion are rather vague, and we are uncertain whether or not it is intended to be antagonistic to the Manchester scheme. We rather think the object of the mover is to obtain an opinion from the House of Commons to the effect that what we may call the superabundant water of the Cumberland and Westmoreland Lakes belongs to the whole of, and more especially to the north of, England, and that, if the Lakes be tapped, a number of towns should be allowed to participate in the generous supply. Oldham and other towns desire to share in the supply from Thirlmere, and there can be no reason why they should be denied the advantage. If Mr. Howard's object is to advocate the rights of these towns to share in the advantages of a superabundant rainfall in a remote district, we cordially agree with him. Windermere, Ulleswater, and Thirlmere, can give a supply of water to the whole of the North of England; but the cost of obtaining such a supply would be enormous, and the outlay would only be justified by combination. We must wait, however, to learn what Mr. Howard exactly means by his motion. Taken alone, the Manchester Corporation have one pre-eminent quality—they contrive to make everything pay; and if the Thirlmere scheme did not promise, on full consideration, to be remunerative, we may be certain they would not embark in the speculation. The leading members of the Corporation of Manchester are business men. Under the conduct of Aldermen Curtis and King the Gas-Works have proved extremely remunerative, and although it cannot be expected that the extended water supply will prove of equal value, we may safely anticipate that it will be made at least self-supporting.

LIGHTING OF RAILWAY CARRIAGES.

On Wednesday last a party of gentlemen, mostly connected with the railway interest, visited the newly-erected works of Messrs. Pintsch and Co., Stratford, to witness their mode of manufacturing oil gas, and applying it to the lighting of railway carriages. The works are situated near a siding on the Great Eastern Railway, which Company are gradually introducing the light into all their carriages. We have before described the nature of the gas and its mode of manufacture, and need here only recapitulate the fact that the gas is formed by causing a thin stream of oil—the commonest petroleum residues are mostly employed—to trickle over plates of iron kept at a bright red heat. In this way about one-third of the oil employed is converted into permanent gas, the illuminating power of which ranges from forty to fifty candles. The gas is subsequently compressed into cylinders, at the pressure of about ten atmospheres. The railway carriages are fitted with cylinders of a similar kind. When one is required to be filled, it is brought alongside in front of the works, and, by means of a stand-pipe and a stout india-rubber hose, the gas is conveyed into the cylinder underneath the carriage. Necessarily some loss of pressure results, and, as a rule, the pressure in the cylinders attached to the carriages does not much exceed six atmospheres. The capacity of the cylinders is, however, such as to contain sufficient gas to light a carriage continuously for more than thirty-six hours. Messrs. Pintsch and Co.'s invention has now been adopted by seventeen Railway Companies—two in this country and fifteen on the Continent. Trains run regularly between Berlin, Paris, Calais, and Ostend, and the double journey only necessitates the refilling of the cylinders at Berlin. We have before informed our readers that, on a trial on the London and North-Western line, a carriage travelled from London to Aberdeen and back without requiring any renewal of the gas store. The advantages of this system to Railway Companies are very obvious, as any one who takes long journeys may perceive. Its economy is undoubted. The cost of each light is about half-a-farthing per hour for the gas. The consumption is estimated at one-sixth of a foot per hour, and no labour is required along the line travelled over. Taking coal gas at 3s. 6d. per thousand, and the estimated consumption at three feet per hour, the economy is not very apparent; but then the cost of labour has to be taken into consideration. The Pintsch system requires no labour, except at the central station. Nearly the whole of the gas used on the continental lines is supplied at Berlin, where alone special workmen have to be employed.

The works at Stratford contain but four retorts, by which, supposing them to be worked in shifts night and day, sufficient gas may be made for fifteen hundred carriages. There are five large cylinders, into which the gas may be compressed for transference to the cylinders under the carriages. The exit of the

gas from these latter cylinders is controlled by a regulator of great delicacy. The gas within the cylinder being at a pressure of, say, six atmospheres, it is supplied to the burners at a pressure of six-tenths of an inch of water. There is also some peculiarity in the construction of the lanterns, of which we are not fully informed. The flame is completely protected from draught, and burns, under all circumstances, with wonderful steadiness. We were informed that not long ago a carriage fitted with these lamps was in Holyhead Harbour exposed to a very severe gale, and when all the oil-lamps in the carriages, and even the guard's lanterns, were blown out, the Pintsch lamps continued to furnish a perfectly steady flame. Whatever may be thought of the comparative light afforded by these lamps and that yielded by the coal gas-lamps used on the Metropolitan Railway, and the oil-lamps used on the long lines, there can be no doubt the invention offers great advantages to Railway Companies, and we may expect to see its adoption greatly extended.

HEALTHY AIR.*

This is, unfortunately, a book which mainly concerns Americans, but a similar work, devoted to the careful consideration of the conditions conducive to health in the British Isles, would be extremely welcome. A good many authors have speculated upon the temperature and the hygrometric conditions of the air which produce the most comfort to the human body. The temperature speculated upon varies from 48° to 70° Fahr., and the moisture from 30 to 80 per cent., of the point of saturation. If, then, according to these authorities, we could only keep the air within these conditions, everybody should be happy and comfortable. Pneumonia should be unknown, bronchitis never heard of, and no child should suffer from chilblains. Unfortunately, however, so perverse is Nature, that we can never ensure a continuance of the state of things which we are told leads to health and comfort. Under some circumstances we get a dry air, which produces much discomfort, and under others we have a too moist air, which is extremely oppressive. These things are to a great extent beyond human control, but Mr. Briggs shows that much may be done indoors to keep the temperature and moisture of the air within limits. If we could live in glass houses in winter, and nobody would throw stones and interfere with our proper means of ventilation, we might thoroughly enjoy ourselves. But as most of us must go into the open air, and encounter the chills of winter, and suffer from the extreme heats of summer, we fear that we must continue to bear the ills which climatic conditions impose. Indoors, however, as Mr. Briggs shows, by proper means of ventilation much may be done to preserve air and moisture at a proper level. He estimates that the air of an apartment must be renewed at the rate of from 40 to 60 cubic feet per minute for each occupant of the room. The estimate appears to us rather high, but we are fond of fresh air, and do not find fault with the author. The amount of moisture is to a great extent independent of our control. It is furnished by a variety of means, not the least important of which is the exhalation from our own bodies. This exhalation may be said to be the most important element in the regulation of the external heat of the body, and here we quote a passage which explains in a few words how this warmth is regulated:—

> There are three means provided for the healthful dispersion of animal heat into the atmosphere; the first is radiation to surrounding colder objects; the second, conduction to the atmosphere, which, for comfort, must be sensibly cooler than the body; and the third is evaporation from the moist surfaces of the lungs, throat, and the roots of the pores of the skin. The first of these means, to the clothed person, at least, is comparatively ineffective, while the relative quantities of heat which may be eliminated in any given time or locality by the two last will probably be found nearly equal in an atmosphere of about 70° temperature, and 65 to 70 per cent. of humidity. In all cases of excess of animal heat, the animal, and mankind as an animal, finds relief in evaporation of water secreted in the system, showing that vaporization is the ultimate means of dispersion of heat.

The book is written, as we have said, for the information of Americans, and deals mainly with the climatic conditions of America. But the principles laid down by the author hold good for all the world, and this little tractate may be studied with profit in this country.

CHIMNEY-SHAFTS AND LIGHTNING CONDUCTORS.†

This book treats of chimney-shafts, stability of chimneys, descriptions of chimneys, and lightning conductors.

It is a very sensible little treatise, which deserves to be thoroughly studied by all engaged in the erection of chimney-shafts. The chapter on lightning-rods is especially interesting. We quite agree with the author that no chimney-shaft and tall building should be without one.

Sewage Treatment.—At the last meeting of the Aylesbury Local Board of Health it was unanimously resolved—"That the Board are perfectly satisfied with the manner in which the sewage of the district has been treated by the Native Guano Company."

Scarborough Water Supply.—The result of the poll of the ratepayers on the question of the transfer of the water-works to the Corporation was declared at a meeting of the Town Council on the 14th inst. There were 1929 ratepayers in favour of the acquisition of the local water-works by the Corporation, and 868 against.

* "On the Relation of Moisture in Air to Health and Comfort." By Robert Briggs, C.E. Philadelphia, 1878.

† "Boiler and Factory Chimneys; their Draught Power and Stability; with a Chapter on Lightning Conductors." By Robert Wilson, A.I.C.E. London: Crosby, Lockwood, and Co., 1877.

LIGHTING BY ELECTRICITY.

(*Continued from page* 86.)

Before closing our remarks upon this important topic, we propose to make a few extracts, from the last and most exhaustive treatise of the day, on the subject. We refer to the work published in Paris during 1877 by M. Hippolyte Fontaine, entitled "*Renseignements Pratiques sur l'Eclairage à l'Electricité.*" The author, who is himself the inventor of a lamp, is evidently a man who understands all the contrivances, both old and new, that have at one time and another been brought into use, or been suggested for the production of this kind of light, and cannot be suspected in any way of having a bias in favour of coal gas.

In a chapter devoted to "The Divisibility of the Light," he writes:

> Scarcely had a glimpse been obtained of the remarkable effects of the voltaic arc, when thought was directed to the division of the electric light, and before even a good regulator for a single focus was in existence, Mr. King took out a patent for a dividing lamp. However, while the creation of a single focus was steadily progressing, and an artificial sun of 4000 burners had been successfully produced by the aid of a motive power of 10 horses—thanks to the retort pencils praised by Foucault, to the Serrin lamp, the Gramme machines, Sautter and Mangin's reflectors, and Carré and Gaudoin's pencils—the divisibility of the light remained pretty nearly stationary, and did not leave the domain of speculation to enter that of accomplished facts.
>
> If it were necessary for us to judge between Mr. King's process, which dates from 1845, and that of M. Jablochkoff, which dates from but yesterday, we should truly be very much puzzled to say which of the two is the nearer to the real solution, due regard being paid to the exceptional merit of the two inventors.
>
> Must it be said that the divisibility of the electric light is incapable of realization, and that we must despair of ever seeing electricity take the place of gas in its multifarious applications? No; a hundred times no. Science is far from having pronounced her last word upon the transformations of this mysterious fluid, which has already annihilated distance, and may very well, at any given moment, abolish night. We simply assert that from a practical point of view, notwithstanding the excitement recently created in Russia by means of puffing announcements, notwithstanding the remarkable labours of M. Jablochkoff, and the no less remarkable initiative taken by M. Denayrouse, there is nothing in existence at the present day (May 1, 1877) that is simple in application, or that may be recommended for a preliminary trial, and *à fortiori* for definitive application.
>
> Every ten years a new idea springs up; Fame, with her hundred voices, lauds it to the skies; then, after a few unfruitful trials, silence is gradually restored. In 1847 the discovery of incandescent carbons, by Mr. King, in England, began to be announced; in 1857, M. de Changy, in Belgium, substituted platina for the carbon, and added a current regulator; in 1867, M. Le Roux, in France, published a method by which the same current was made to pass alternately and very rapidly into several ordinary regulators; finally, in 1877, M. Jablochkoff, a Russian officer, caused the spark to pass on to a plate of kaolin, and thereby obtained a series of small lights.
>
> We believe that for such great efforts to be crowned with success a new source of electricity would have to be discovered, or some means found of commercially utilizing atmospheric electricity.
>
> In order to avoid onerous trials and such frequent disappointments, it would be sufficient to know the equivalent mechanism of light as we know that of heat.
>
> Each of the systems proposed contains something—a great deal—that is good, and, doubtless, each is capable of rendering important service in special cases. The mistake made by inventors consists principally in desiring to make the use of their apparatus too general, and in talking of immediately suppressing gas lighting. True, electricity has already an immense field of operations, and it presents great advantages in a vast number of applications; but from performing its present functions to acting as a complete substitute for gas there is a great interval, which will very probably never be completely traversed. We have never so much admired the facility of employment, the simplicity of installation, the indefinite divisibility, and the multiplicity of the uses of gas, as since we have been occupied with lighting by electricity.

Thus far we are at one with M. Fontaine, and we can truly say that we never were more thoroughly convinced of the inappropriateness of this subtle fluid for the supersedure of gas, and the extinction of darkness, than we are at this moment, notwithstanding its power to annihilate distance. What can equal the simplicity of the means employed for the introduction of gas to the place where it is required for the various uses to which it is now applicable? A pipe is laid from the main of supply to, and into, the house; from the end of this pipe smaller ones ramify, and reach the points where light or heat is required; here the specialities for combustion are fixed, and light, or heat without light, is produced by simply turning a tap and igniting with the flame of a taper. After that it is a matter of simply leaving the accomplishment alone as long as the manifestation of one or the other, or both, is needed. The reversal of the taps which had previously been turned on puts the gas-flame out, and all operations cease without further trouble. If the burners are to be of such a nature as to maintain a uniform flame for any length of time, notwithstanding the variations of pressure in the mains, the appliance for producing this result is really within the dimensions of a Spanish nut shell, and is as lasting as the burner of which it is a part. In all the multifarious applications of coal gas, there is no more skill or attention demanded than a maidservant can supply, nor do they in any way compromise the safety of the premises in which they are carried out. The "sulphur" bugbear is nearly gone, but the carbonic acid remains, and must continue as long as carbon forms a part of the agent of luminosity; and as carbon is the light-producing constituent in both cases, the two methods of illumination are on a footing, in principle, with regard to the carbonic acid and nitrogen set free.

The heat also evolved by the electric light must be something considerable, unless M. Werdermann made a great mistake when he took out a patent, in 1874, for "An improved method of cutting rock or stone or other hard substances," the secret of his invention being the application of intense heat obtained by means of electricity.

And here we may remark that it is in this patent that we, for the first time, find the carbons placed side by side, as since proposed by

M. Jablochkoff, and the voltaic arc induced to cross from one point to the other at right angles to the axis of the carbons, instead of in a line with it. Hence our reason for referring to the specification in connection with this subject, that has, otherwise, only to do with the light of the voltaic arc. M. Werdermann says:—

When the rock is very hard, as porphyry, granite, gneiss, and the like, I prefer to use an electric blow-pipe. Figure 12 is a plan of an apparatus for carrying this part of my invention into effect. In this apparatus the carbon points, *g*, of the electric light are fixed on a suitable handle or frame provided with pinions, *h*, and racks, h^1, to regulate their distance. I blow through the voltaic arc over the two carbon points, *g*, a powerful current of air or steam or other suitable vapour or gas. For this purpose I provide a carbon tube, *k*, arranged over the carbon points, *g*, and provided with an adjusting pinion, *l*, and rack l^1. The air, steam, or gas is supplied to the carbon tube by a pipe, *m*. When the blast is in operation through this tube, and the light is burning, the flame of the voltaic arc will produce the effect of a powerful blow-pipe; g^1, g^1, are wires connecting the carbon points, *g*, with a battery.

And in a subsequent part of the specification he tells us that "the heat obtained by this apparatus is so intense that the hardest granite is thereby not only calcined, but is fused in a few seconds."

Reverting to M. Fontaine's work, we read in the chapter from which we have already quoted:—

We do not call *divisibility of the electric light* the production of several intense focuses with the same machine or with the same voltaic pile; here it is more a question of small focuses, those of from 1 to 15 Carcel burners, for example. It is undeniable that several lamps may be supplied from the same magneto-electric apparatus; then it is simply a question of ascertaining whether the single apparatus does not cost more in fitting up and setting in operation than a series of small ones, each supplying

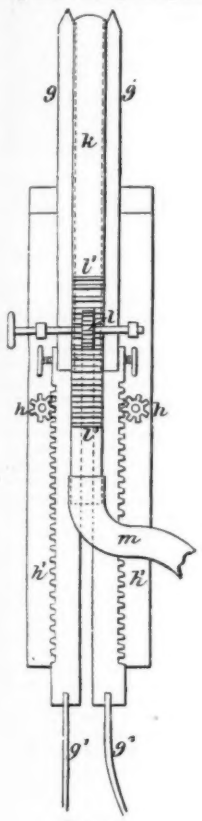


FIG. 12.

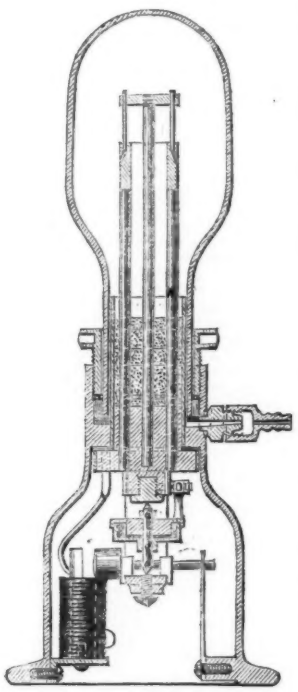


FIG. 13.

one lamp. Up to the present time we have always been in favour of the latter method of installation, but have always encouraged investigations into the merits of the former, and it is not impossible that M. Gramme may yet have the honour of making it thoroughly practicable.

It being quite understood that the divisibility of the electric light is not practically realizable, at least at present, and with the means proposed up to now,* we pass to the examination of the principal systems contrived for the solution of the problem.

We have already seen, by the result of direct experiments, that the invention of Mr. King, re-invented by M. Lodyguine, and perfected by M. Konn, was more suitable for a single focus than for divisibility; however, the incandescence of the small carbons in vacuum is very advantageous as regards the fixity of the light and the small expenditure it entails. Before rejecting its employment altogether, further experiments should be made with shorter and less bulky carbons of various qualities. It might be possible to succeed in employing this system where only one lamp and great regularity of light were necessary. Some experiments commenced by us in view of the realization of this idea will soon be completed, but it is impossible just yet for us to formulate their results, even approximately.

We remarked above that M. Fontaine is himself the inventor of an electric lamp, which, however, has not yet been practically tried. He gives the following description and drawing of it:—

"This lamp, which is shown in fig. 13, is actually in course of construction by M. Bréguet. It is characterized by the two following points—1. The carbons are fixed by each of their extremities in rigid contact, and maintained fixed, which permits the lamp to be used in all positions. 2. The electric current passes automatically from one carbon to the other by the action of an electric magnet introduced in the circuit. Even a summary description would not be of great interest, since the lamp is not yet made. Besides, the figure indicates sufficiently the arrangement which we have adopted to realize our aim."

(To be continued.)

* The fact must not be lost sight of that we are speaking only of the present, without prejudice to the future. We shall scarcely, from time to time, put forward any opinion upon experiments in course of execution, as we do not wish to discourage any one, or give any incorrect information to manufacturers who desire to know our opinion.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CLVI.

PUBLIC LIGHTING.

Civilized society is indebted for much of its industrial progress and material prosperity to the lighting of the public streets and roads by coal gas. The change from the old mode of public illumination by means of the flaming torch, and the ancient falot or fire-basin, and even the more modern train-oil lamp, with its uncertain glimmer, to the present system, must be reckoned as one of the triumphs of the nineteenth century.

The courts and narrow entries and alleys that are common to most large cities and towns should be efficiently lighted. The Metropolis is a marvel of admirable arrangement in this respect. Were it otherwise, the opportunities for committing crime, and the incentives thereto, would be indefinitely increased, and there would be little safety in traversing the streets and bye-ways after nightfall. Under existing conditions the avocations of life can be pursued as easily and as safely by night as by day.

No absolutely fixed distance can be named as that at which the public lamps should be placed apart. This may vary from 25 to 70 yards, depending upon the character of the street or locality lighted.

In places where the lighting is used for purposes of decoration and ornamentation, as well as for public convenience, the lamps are frequently placed at nearer intervals than 25 yards. It may be taken, generally, that it is not desirable that the maximum interval should exceed 70 yards.

Lamp-posts, as a rule, should be fixed upon the footpath, at a distance of 12 to 18 inches away from the street gutter. This will be a little beyond the kerbstone, in the flag nearest thereto, and will be out of reach of the wheels of passing vehicles, as they batter towards the footway.

When the trench to receive the base of the column or pillar has been excavated, the soil should be well rammed and levelled, and a flag about 24 inches square and 4 inches thick placed at the bottom as a solid bearing for the lamp-post to stand upon.

Should the column be furnished with a single ladder rest, this may either be cast upon the column, or made of wrought-iron bolted thereto, and may be fixed to project over the footpath. When two arms are provided, these are usually cast upon the column; in this case they are placed so as to project from each side in a line parallel with the street.

Great strength is not required in a lamp-column. If made reasonably strong, it cannot be injured by any traffic on the footpath; and if by accident the wheel of a passing vehicle should come in contact with it, it is usually better that the column should give way and fracture than otherwise.

Lamp-columns are generally made ridiculously tall, as though they were intended to light the clouds instead of the public ways. This is an error that ought to be rectified. By reasonably diminishing the elevation of the lamps, a very important improvement in public lighting would result. Ten feet from the ground line to the burner is a convenient and serviceable height.

Excess of ornamentation in ordinary street lamp-columns should be avoided. At the same time it must be admitted that the pattern of some of those in many large towns is as ugly and undesirable as can well be imagined. An elegant and chaste design is not necessarily more expensive than its opposite; but, on the contrary, will generally be found cheaper, because lighter, and better suited to the purpose intended.

LIQUEFACTION OF NITROGEN AND HYDROGEN.—A correspondent of *The Times* writes:—"The *Journal des Débats* announces that on Dec. 31, M. Cailletet, who eight days previously had succeeded in liquefying oxygen, was equally fortunate with both nitrogen and hydrogen, although perhaps it might be said that in the case of the latter gas the performance was not thoroughly complete. The experiments were made in the laboratory of the Ecole Normale, in the presence of MM. Boussingault, Henri Sainte-Claire Deville, Berthelot, Mascart, &c., and these eminent men declared themselves thoroughly satisfied. The nitrogen was reduced to the condition of little drops, while the hydrogen became visible in the form of a vapoury cloud. This was effected in the case of the nitrogen under a pressure of 200 atmospheres, and in the case of the hydrogen under a pressure of 280 atmospheres. In both cases the temperature was reduced to 300° below zero, Centigrade. Thus at last it has been demonstrated that all the gases, without exception, are subject to the common law, and can be reduced to a liquid state. The cold and atmospheric pressure together exercise so great a force of compression on the gaseous molecules, that they are compelled to take the liquid form. Atmospheric air is composed almost exclusively of oxygen and nitrogen; since, therefore, each of these gases has now been separately liquefied, it would seem that their mixture also ought to be open to similar treatment. M. Cailletet accordingly took some air, which he thoroughly dried and purified from carbonic acid, and liquefied it in the same apparatus which had been so successfully employed in the previous liquefactions. When he turned the cock the metamorphosed air trickled out, like some perfumed liquid from an evaporating bottle. It is obvious that it is only a question of carrying these experiments further, in order to reduce those liquid gases to the solid form. The demonstration that it is possible to obtain 'lumps of air' is one of the greatest victories of modern physical chemistry. The 31st of December ought to be a memorable anniversary in the scientific calendar."

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

PORTLAND CEMENT CONCRETE.

SIR,—In reply to Mr. G. Livesey's letter, in your issue for Jan. 8, p. 50, I beg to state that I am not an opponent to Portland cement concrete, therefore it is unnecessary for Mr. Livesey to defend its good name on my account. If Mr. Livesey will carefully read the article alluded to, he will find I there stated that I preferred the concrete walls, for gasholder-tanks, with a brick lining; also that concrete, when properly worked, is one-third stronger than brick. I gave also my reasons for saying so, and stated that I in no way advocated the superiority of brick over concrete tanks.

With reference to Mr. Livesey's tank, although he states that the cause of weakness has been discovered, he does not explain in his letter what that cause was. I am aware that he did at one time suggest that, in all probability, the cracks were caused by the difference in the temperature of the water while filling the tank. This I carefully considered, and, after examining the nature and strength of the material, I came to the conclusion that this could not be the cause. I, therefore, attributed the cracks (as stated) to the weakness of the walls.

With regard to the decreased leakage, knowing that concrete does not corrode, and considering the stillness of the water in the tank, little or no sediment would settle in the cracks, therefore the decreased leakage is not due to the cracks taking up, but to the saturation of the adjacent ground.

Mr. Livesey says it is now known that any cracks that may occur in a tank of this description can be stopped; but he does not tell us how. I therefore assume that it is done by stemming the cracks with hemp soaked in linseed oil. Mr. Livesey then states that, had his tank been made water-tight with puddle, as is usual with brick tanks, there would have been no cracks. On this point I agree with him, for it substantiates and accords with the paper to which his remarks refer. He then says that no comparison can be made. Allow me to state that there are tanks of large capacity—viz., 163 feet in diameter, the walls of which are built of concrete with a brick lining, that have been in full work for a considerable time, and which have not cracked or failed in any way, the concrete wall, including the brick lining, being about the same thickness as Mr. Livesey's tank wall. But until a tank made entirely of concrete has been completed and put to work without cracking or failing in any way, I think that I am fully entitled to say that my conclusions are correct, for a cracked tank, although repaired, cannot be considered as sound as one that has not been cracked.

In conclusion, I consider all honour due to Mr. Livesey for putting his ideas (viz., tanks entirely of concrete) into actual practice at his works, and I for one wish him every success in building similar tanks in future. JOHN CHATTO.

17, *Dresser Street, Hunslet Road, Leeds, Jan.* 12, 1878.

CORRECTIONS.

SIR,—I hasten to apologize to the very able author of your "Treatise," in the praise of which, as you are aware, I have always been loud. Indeed, as far as I know, there is no such compact, well-digested, and valuable mass of information on the subject of gas manufacture anywhere to be found.

I do not know how I could be so stupid as to confound, which I seem to have done, the case mentioned with that of the comparison of the rates of effusion of different gases under the same pressure, which rates are inversely as the square roots of the densities.

But my second stricture is just. The "pressure of the gas in the main" does not increase in proceeding from lower to higher points; but actually diminishes, as in all fluids, whether gaseous or liquid. Any applied pressure, as that given by the weight of the holder, is propagated throughout the fluid, increasing the pressure at all points; but not more at a higher than at a lower point. What workmen observe as the "pressure of the gas" is the difference between the pressure of the gas at any point in the main and that of the atmosphere in the open end of the gauge, applied at the same point. And the pressure of the atmosphere diminishing from point to point upwards much more than that of the gas, the excess of pressure of the latter over that of the former increases.

Nothing could be further from my intention than saying anything to disparage the excellent "Treatise," to which I and all who take an interest, whether practical or scientific, in gas manufacture are so much indebted.

Sidney Sussex College, Cambridge, Jan. 17, 1878. ROBERT PHELPS.

IRVINE WATER-WORKS.

SIR,—We notice a paragraph in your issue of the 15th of January, that our estimate of these works was £26,500, and that they will eventually cost £38,000 or £40,000. This gives a wrong impression to the public, as our original estimate was £24,000, exclusive of land and way-leave, which we do not pretend to estimate in value; and we find that the works when finished will cost £26,500, and it is the land and way-leave which will bring the cost up to £40,000; but we have not yet learned the result of the land references. Be so good as to correct this in your next. J. AND A. LESLIE, Engineers to the Works.

72A, *George Street, Edinburgh, Jan.* 16, 1878.

YAN YEAN WATER-WORKS.—The reproductive character of the Yan Yean Water-Works is shown by the cash statement and balance-sheet for the year 1876-77, which has been presented to the Victorian Parliament. The revenue received for the year amounted to £84,007, of which £80,580 was from water-rates. The amount disbursed on construction of works from their commencement up to June 30, 1877, was £1,382,565; on maintenance, £55,563; on departmental expenses, £121,369; and on sewerage, £22,314. The amount of revenue received to June 30, last year, was £1,265,629, and the amount repaid to the Victorian Treasury was £956,827.

Parliamentary Intelligence.

GAS AND WATER BILLS, 1878.

The following additional memorials, complaining of non-compliance with the Standing Orders, were deposited in the Private Bill Office on or before the 16th inst.:—

Dublin Corporation Water-Works Acts Amendment Bill, from Rathmines and Rathgar Improvement Commissioners.

South London (Spring) Water Bill, from (1) Lambeth Water-Works Company; (2) Kent Water-Works Company.

HOUSE OF LORDS.

THURSDAY, JAN. 17.

The MARQUIS of RIPON gave notice that on Monday, Jan. 21, he would call attention to the report of the Select Committee of last session on Conservancy Boards, &c.; and ask the Lord President whether it is the intention of Her Majesty's Government to introduce in the present session a Bill founded upon the recommendations contained in that report.

HOUSE OF COMMONS.

THURSDAY, JAN. 17.

Mr. EDWARD HOWARD gave notice that on Tuesday, Jan. 29, he will move for a Select Committee to be appointed to inquire into the supply of water to the manufacturing districts of Lancashire and the West of Yorkshire, and any deficiencies likely to arise therein; and whether it is necessary or expedient to resort to the Westmoreland and Cumberland Lakes to make good any deficiencies in such supply; and, if so, to what extent, and under what conditions, such resort should be sanctioned.

FRIDAY, JAN. 18.

PUBLIC HEALTH (IRELAND) BILL.—A Bill to consolidate and amend the Acts relating to Public Health in Ireland was brought in by Sir Michael Hicks-Beach and the Attorney-General for Ireland; and read the first time.

METROPOLIS WATER-WORKS (PURCHASE) BILL.—A Bill to make provision for the purchase by the Metropolitan Board of Works of the undertakings of the several Water Companies supplying water to the Metropolis and to certain places in the neighbourhood thereof, and for the supply of water by the said Board to the Metropolis and to such places, and for other purposes relating thereto, was brought in by Sir James M'Garel-Hogg, Sir Andrew Lusk, Mr. Grantham, and Mr. Rodwell; read the first time, and referred to the Examiners.

PUBLIC HEALTH ACT (1875) AMENDMENT BILL.—A Bill to amend the Public Health Act, 1875, was brought in by Mr. Alexander Brown, Dr. Playfair, Mr. Ryder, and Mr. Joseph Cowen; and read the first time.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

LAMBETH VESTRY.—At the meeting on Thursday last, the Lighting Committee reported that application had been made to the South Metropolitan and Phœnix Gas Companies to know what reduction of charges they would make if their lamps were lighted half an hour after sunset, and extinguished half an hour before sunrise. The South Metropolitan Company replied that at the present time they estimate they were supplying the vestry lamps with gas at 2s. 11d. per 1000 feet, and that the cost of lighting by the change would oblige them to raise the charge to the rate of 3s. 2d. per 1000 feet. The Phœnix Company stated that such exceptional arrangement, in practice, would be most complicated and expensive, to light and extinguish the lamps of different parishes at different times, and would more than counterbalance the value of the gas saved. Where similar changes had been made, dissatisfaction had been the result, and the parishes had returned to the plan of lighting and extinguishing at sunset and sunrise.

METROPOLIS WATER SUPPLY.

THE METROPOLITAN BOARD NEW WORKS BILL.—A largely attended meeting of the Owners and Ratepayers residing within the District of the Uxbridge Board of Health was held at the Public Rooms, Uxbridge, on Thursday night, with reference to the proposal of the Metropolitan Board of Works to obtain a supply of water at Red Hill, Denham, Bucks, and Hayes, Middlesex. The Rev. A. D. Hilton, Chairman of the Local Board, said the members of the Local Board were unanimously of opinion that it was their duty to take immediate steps to protect the town from injury, it being very probable that the Red Hill works would drain the Uxbridge works, and render them and the drainage, which had together cost £35,000, perfectly useless. The following resolution was unanimously passed:—"That this meeting approves of the proposal of the Uxbridge District Local Board of Health to oppose the Bill in Parliament promoted by the Metropolitan Board of Works for the Metropolis water supply, and to charge the expense of such opposition upon the general district rate under the control of the Local Board. At the same time this meeting requests the Uxbridge District Local Board of Health to endeavour to arrive at some amicable arrangement with the Metropolitan Board of Works for the protection of the water supply, and for the interest of the district, before taking active steps to oppose such Bill."

METROPOLITAN ASSOCIATION OF MEDICAL OFFICERS OF HEALTH.—At a Meeting of this Association, on Friday last—Dr. Stevenson presiding—Dr. Tidy, the Medical Officer of Health for Islington, gave a *résumé* of a paper he is preparing on the Water Supply of London. He compared the supply of London with that of Paris, and contended that the London supply was larger than that in the capital of France; and, with respect to quality, he was opposed to the opinions of those who had stated that the London supply was unwholesome. He contended that turbidity was not a proof of unwholesomeness. Dr. Tripe contended that solid matters in the water were injurious. Dr. Bartlett dwelt upon the extremely bad condition of the water supplied by the Grand Junction Company. The New River water from the springs was good, but when the waters of the Lea were added they were often turbid, and he thought that the Water Companies, when the water supply was below the given standard of purity, should be subject to fine in the same way as Gas Companies were. Dr. Corfield added that it was known that disease germs were often passed into the rivers, and the question to be considered was whether these germs or the poison of disease could be removed. He contended that there was no certainty that the poison from disease, if poured into the rivers, was really removed from the water by filtration. Mr. Angell directed attention to the fact that vast numbers of persons lived on the rivers above the intakes of the Companies, and, in proof of the danger arising from the sewage contamination of the waters, pointed to the report of the Registrar-General, who held that the cholera in the East-end, some years ago, was caused by an accidental contamination of the East London Water-Works Company's water with sewage. Dr. Tidy, in reply, maintained that oxidation in the flowing river provided a remedy for the presence of sewage, and that filtration gave a security for a good supply.

LONDON WATER SUPPLY.

At the Meeting of the Social Science Association, on Monday, Jan. 14, the subject for consideration was the London Water Supply, a paper being read by Mr. LEWIS ANGELL, C.E., Hon. Fellow of King's College, London.

The chair was occupied by Mr. EDWIN CHADWICK, who, in opening the proceedings, said that the dual scheme of the Metropolitan Board was at variance with the lessons of his 30 years experience at the old General Board of Health. The result of its inquiries was the recommendation that recourse should be had to the sources of river supplies—namely, the springs at their heads rather than the streams themselves, and to soft water rather than hard, as well as to constant distribution and street hydrants. These principles had been applied in provincial towns with undeniable advantages. At the time of the inquiries referred to, a partial examination of the soft spring supplies in Surrey and Middlesex showed that they were double the consumption. These soft spring waters were not more than about one-fifth the degree of hardness of the deep chalk spring supplies; and the works for deep springs were more expensive and uncertain—about one in three being successful. Richmond had been led into a deep spring speculation, while surface springs would have furnished a supply at much less cost. But the engineering mind was prone to prefer visibly big collecting works, and by Clark's process deep spring waters could be reduced to the softness of sand, spring, or of lake waters. Unity of management in London ought to result in a saving of water and expense which would defray the costs of fittings for constant supply, of hydrants, and of new supplies. The deep chalk spring supply was admittedly limited, and it was not necessary to resort to it, because the sufficiency of surface spring supply could be placed beyond doubt. It was more economical to use a small proportion of good water for sanitary purposes, than to incur the expense of a separate system of mains; and for clothes-washing, for boilers, for steam power, and for art purposes, it was desirable that water should be as free from foreign matter as for drinking purposes. The Companies mains were adequate to the high pressure required for hydrants and fires. The hydrants should be in charge of the police, so that there would be, instead of 400 or even 900 trained firemen, 9000, of whom 4000 would always be on duty, and water might be made available in two minutes instead of fifteen. The risk to life and property would be reduced to a third of what it now was. The Board's estimate of £8 per house for rendering service-pipes sufficient for high pressure was an exaggerated one in the face of the fact that the change was effected in Manchester at 11s. 6d. per house. To sanction the duplicate plan would be to add another blunder to that of throwing the sewage of the Metropolis into the sea without purifying the Thames. In conclusion, he contended that the saving under united management would reduce the quantity really needed so far as to exclude any pretext for restricting the ordinary consumption for domestic or other purposes; that, with inconsiderable alteration, the present mains would suffice to receive the new supply and bear the necessary pressure; and that neither for the domestic supply nor for fire prevention was a duplicate system of works needed.

Mr. ANGELL then read the following paper:—

The somewhat hurried action of the Metropolitan Board of Works in promoting a Bill for a radical change in the arrangements for the Water Supply of London, has brought the subject under the consideration of the Health Committee, who have unexpectedly honoured me with a request to introduce the subject to the Association for discussion, and in the following paper I propose briefly to review the sanitary and financial features of the question.

Water constitutes about three-fourths of the human body, and is essential to the sustenance of all organized beings, for without it neither animal nor plant can exist. But if the water received into our system be impure, the animal functions suffer, the food is not assimilated, the blood is not clarified, and the whole system may be poisoned.

All sources of water supply, whether derived from springs or rivers, are due to rainfall. Taking the average at 32 inches, it is calculated that more than 27 billions of gallons annually fall over the area of England and Wales—a quantity, deducting percolation and evaporation, sufficient for a population 25 times greater than the present, including beasts and machines.

The pure water of the chemist, a combination of two volumes of oxygen and one of hydrogen, is not found in nature; being more solvent than any other known liquid, and having an extensive range of affinities, it is impossible to find it pure. The waters of heaven are fouled before they reach the earth, by contact with floating matter in solid and gaseous forms. The very best water contains a certain proportion of impurity, but within limits such impurities are harmless.

Spring waters, which have filtered through the surface, generally contain mineral or inorganic combinations in greater excess, while organic impurities, especially in nitrogenous forms, representing the result of animal decomposition, abound in river waters, and are the most harmful.

Rivers are the natural drainage channels of the lands within their watershed, and when the catchment basin is either populated or highly cultivated, the rivers must, under the most favourable circumstances, inevitably be polluted by decomposing vegetable and animal products, from manured lands, by the filth of towns, and by the refuse of manufactories.

The essential conditions of a good water supply are—(1) a pure source; (2) constant service; (3) high pressure; and (4) public control.

Neither of these conditions exists in the Metropolis. The supply of so essential a necessary to human life and health is subordinate to considerations of trade. There are eight distinct private and independent Companies which supply London with water. The eight Companies had expended to the end of 1876 more than 11¼ millions sterling, and the income for that year was £1,891,861 16s. 2d. The daily average quantity of water supplied to the Metropolis was 118,725,718 gallons, or at the rate of 31½ gallons per head, or 11 gallons per head more than is found necessary for the population and trade of Manchester. In London there is neither public control nor unity of management. Rival mains exist in the same streets. There is a waste of between £100,000 and £200,000 in the multiplication of directorates, of staff, and in loss of water.

Seven out of the eight Companies obtain their water from sewage-polluted sources. In dry weather the New River Company obtain a portion of their supply from wells, but the water flows in an open conduit to London, exposed in its course to contaminating influences. The Kent Company alone supply pure water, from the chalk, to about one-sixteenth of the population. It is within the memory of many, when water was pumped, for domestic purposes, from the Thames, at Hungerford Bridge, within a few hundred yards of the room in which we have met. From time to time improvements have been made by removing intakes of water to positions more remote from town, and now the supply from both the Thames and the Lea is derived above tidal influence; but, above the present points of intake, on both rivers, a very large and rapidly-increasing population inhabit the banks of the main streams and tributaries, and the entire basins are highly cultivated.

Dr. Frankland, in his last annual report, says: "When the heavy rains of December set in, the accumulated filth of the summer and autumn was swept into the neighbouring streams. The Thames overflowed its banks washing the manure from the cultivated land, and liberating the water from stagnant ponds and ditches. Thus, during the last month of the year the Thames was laden with organic matters of the most objectionable origin, which, carried down to the intakes of the Metropolitan Water Companies, passed through the filters, and were distributed to consumers. Since January, 1873, the Thames has never been in such a filthy plight; and, although most of the Water Companies drawing from this river have greatly improved their subsidence and filtration plant since that date, no care, foresight, or appliance could convert the 'puddle' (to quote an entry in the books of the West Middlesex Company) which entered the Companies works, into wholesome, potable water fit for dietetic purposes. These uncontrollable and frequently occurring outbreaks render this river a very undesirable source of water for domestic use."

Major Bolton, in his last report, states: "As the sources of the greater part of the water supply to the Metropolis are polluted from time to time by the prevalence of floods, it may be again advisable to draw public attention to the fact, that notwithstanding the greater care exercised by most of the Companies in the storeage and filtration of water, the organic pollution contained in the Thames water delivered in London, though subject to fluctuations from the greater or less prevalence of floods, still continues to exist." This shows clearly that the waters of the Thames and Lea are being deteriorated by sewage pollution.

The Rivers Pollution Commissioners in their last report (1874) say of the Thames: "There is no hope of this disgusting state of the river being so far remedied as to prevent the admixture of animal and other offensive matters with the filtered Thames water as delivered in the Metropolis. We, therefore, recommend that the Thames should, as early as possible, be abandoned as a source of water for domestic use."

Of the River Lea, the Commissioners report: "Sewage and other disgusting matters reach the intake of the Metropolitan Water Companies drawing from this river, and the soluble portions of such matter are not wholly eliminated by the efficient filtration to which the water is subjected before delivery. The water of the Lea is slowly, though irregularly, deteriorating from year to year, and there is no hope of purifying it to such an extent as to render it at all times safe for domestic use. We, therefore, recommend that the Lea should also be abandoned as a source of potable water."

During the past year, some of the water supplied to London has been officially reported "turbid," and "full of moving organisms."

The trading Companies who sell this diluted sewage profess to eliminate the contamination by the mechanical process of subsidence and filtration. We are told that the putrefactions of animal matter and infectious excreta are oxidized, and their vitality destroyed, by dilution and motion; that, notwithstanding the amount of admitted pollution, the general results are good and wholesome; and that the effect of the Conservancy and Rivers Pollution Acts will be to intercept sewage and remove the old sources of pollution. But, I submit, it is not sufficient that general results are good if the source be bad. In times of general health, water containing diluted sewage may be harmless in its effects, but when evacuations of typhoid and cholera exist, the diluted sewage is no longer harmless, but actively poisonous. The masterly report of Dr. Farr on the cholera epidemic of 1866 proves conclusively that one of the Water Companies supplied a "dose of cholera matter," which killed nearly 4000 persons; hence the folly and the risk of depending on sources of supply subject to such foul contaminations.

It may be replied that these are things of the past, and such blunders will not recur, especially under the protection of the Rivers Pollution Act. Can we rely on the purification of sewage by towns? They may do so ostensibly, but practically the tank and chemical systems which are being adopted are a delusion; they diminish the polluting powers only to a slight extent; there is but little purification of soluble organic matter. How much pollution escapes at night and odd times, as the result of carelessness or intention! Should a population of four millions be subject to these conditions?

That we should derive our domestic water supply from sources contaminated by the filthiest of pollutions, and urge that such pollutions are effectually removed by oxidation, by subsidence, or by filtration, is a theoretic conceit repugnant to science, to common sense, and to those instincts which are implanted within us by a beneficent Providence for our self-preservation.

I therefore submit that the present river sources of supply to the Metropolis for potable purposes are impure and dangerous, and that a new source is necessary.

Even if the present sources were pure, the existing arrangements would deprive us of the advantage. Pure water should be delivered pure, without stagnation and deterioration from contaminating sources.

It has been aptly put that the result of the present intermittent system is to make "a good supply bad, and a bad supply worse." The present system of distribution and storeage is of the worst possible kind. The water is first stored at the works, and then transferred to the London cisterns.

The butts and cisterns of London, especially in the poorer neighbourhoods and smaller houses, and their name is legion, are situated in close courts, and contiguous to every kind of filth; generally placed over the water-closet, near a sink and dust-bin, untrapped pipes communicating directly from the cistern to the soil drains. They are frequently uncovered, consequently the water absorbs the impurities of the surrounding atmosphere; they are not cleaned out from one year's end to another, so they accumulate mud and slimy vegetation. In short, the water, however good originally, becomes offensive and unwholesome. Is it to be wondered that the London beverage is not water?

Nor is this condition of things limited only to the houses of the poor. In the civic palace of this, the wealthiest city of the world, three-quarters of an inch of floating fungi scrub was recently found on the surface, and three-eighths of an inch of mud at the bottom, in the cisterns which supply my Lord Mayor, while a bottle of water on his lordship's table contained hundreds of nematoid worms. Nor is the West-end better than the City, for in the cistern of the Athenæum Club, St. James's, was found a large quantity of offensive mud and animal organisms.

It is unnecessary to multiply instances, or enlarge on the evils of the intermittent supply. It results in the waste of nearly half the water supplied, and the contamination of the remainder. The facts are incontrovertible, and beyond the range of discussion.

The maintenance of a constant supply in the street-mains, a constant service to every house, and the discontinuance of storeage cisterns for drinking and culinary purposes, are, therefore, essential conditions of a good water supply.

In the present condition of things in London the necessary change from an intermittent to a constant system involves formidable financial consideration. Constant service will require new fittings to resist the pressure. There is, as might be expected, great opposition from owners of house property, especially of the smaller class, whose incomes depend largely on this source, to the cost of substituting proper water-fittings for the constant system—an opposition which is supported by the formal resolutions of Vestries and District Boards in the interests of property

owners, and there is something to be said on their behalf. Is it equitable that the cost of the necessary change of fittings, to secure so necessary a sanitary advantage as a constant supply, should be wholly imposed on landlords? Under the Public Health Act, the cost of private improvements may be extended over 30 years, or, what is more analogous, under section 24 of the same Act, where, for public reasons, it is found necessary to alter private drains, the cost of such private alteration is thrown on the public rates. The cost of adapting the house fittings to a constant service would be oppressive if levied at once on the owners of small property; the purity of water is a public question, and the cost ought in the first instance to be arranged on some equitable basis between the public and the owners. Some of the Companies are competent to give a constant supply, but it is only adopted in a small proportion of houses on account of the difficulty of fittings. The annual saving in water alone by better fittings would go far to defray the cost of the change.

The existing pressure of the London Companies is admittedly sufficient for domestic requirements, but utterly inadequate for a general fire service. Under the present mechanical arrangements, if the mains be charged, which is not always the case, water is delivered at the road level, the pressure of the Water Companies is practically useless by a jet under the conditions of friction through hose; it is, therefore, necessary to wait for the arrival of fire-engines to project such a jet, and much water runs to waste from street plugs. The real value of water is obviously at the first outbreak, when a few gallons will prevent a conflagration. Fire-engines prevent the extension of fire, but generally arrive too late to save the premises first attacked.

The fire establishment of London, efficient as it is, is ridiculously small as compared with other great cities. London boasts to be the largest, wealthiest, and most populous city in the world; but its fire establishment costs in relation to population only one-half that of Paris, and one-tenth that of New York. £80,000 is spent annually in the protection of property worth at least £1,000,000,000, only one-half of which is insured. The weakness of the system in London is, however, not want of water, nor of men, nor of skill, but in the cumbersome arrangements. Captain Shaw reports the total quantity of water used at 1682 fires in 1876 was only 21 million gallons, although double the amount of the previous year. Of this quantity less than 8½ million gallons were taken from the fire-plugs; therefore, out of nearly 120 million gallons daily supplied to London, only the small quantity of 23,000 gallons was required for fires. Small as the quantity was, it would have been very much less could it have been quickly applied from the nearest hydrant by the nearest policeman, and many a "serious" fire would have been avoided.

It is in the fire department that the necessity for unity of management and public control of the water service is most apparent. On the outbreak of a fire, messengers have to be sent more than half a mile in one direction for the firemen, and half a mile in another for the waterman, but the policeman, who, perhaps, discovered, or had first notice of the fire, is comparatively useless; whereas, if the police had ready access to a length or two of hose to attach to the nearest hydrant, charged at high pressure, the fire would have been extinguished without either fireman or turncock, whereas, under the present system, the Fire Brigade arrive too late to prevent a conflagration. In Manchester, by the hydrant and police system under unity of management, 97 per cent. of the fires are confined to the rooms in which they occur.

Under present arrangements it is within the range of possibility that the Metropolis may, through an unfortunate combination of events, suffer from fire as other great towns have done. The late Mr. Braidwood contemplated a second Fire of London if once a fire obtained mastery in one of the large stacks of new warehouses during a high wind. Since Mr. Braidwood's time, there has been but little improvement in the water service, and Captain Shaw declares the Fire Brigade to be over-strained, and that his force of 398 men should be increased to 930.

In 1876 I had occasion to report on the fire arrangements of a thickly populated manufacturing district, outside the area of the Metropolitan Board of Works. I then said: "The fire arrangements should be in the hands of the police, who patrol in all directions, and are generally first to call the engines. A disciplined force, with a reserve on duty night and day, and ready to *act* instead of *calling others*, would undoubtedly form the most efficient brigade." The Select Committee of the House of Commons on the Metropolitan Fire Brigade have since made a similar recommendation.

Undoubtedly a special fire organization must also be maintained, as at Manchester and other large cities; but it should be a department of police; and every one of the 10,000 police who in turn patrol every street, day and night, should also be a fireman on his beat, and, when he discovers a fire, his first act should be to do his best to put it out, until reinforced from the nearest fire police station. With a fire brigade so organized, and the water arrangements under public control, and capable of giving due pressure, the Metropolis might look for comparative immunity from destructive fires.

The plausible objection to placing the fire service of London under the police is that it would be beyond the representative control of the ratepayers, who provide the funds. But, for imperial reasons, the police of London are already extra-municipal, and if, as is evident everywhere, the fire service is more efficiently conducted by the police, it follows that, in the public interest, the fire service of London should also be exceptional. Imperial interests, imperial treasures, and a population of four millions are exceptional features.

But to recur to the main question:—What is the best practicable remedy for the radical defects in the purity, pressure, and control of the London water system?

It is the modern experience of most large cities that the rapid increase of population, a better appreciation of sanitary principles, and the greater range of social requirements outgrow the old machinery and organization. The water question is one of these. This new necessity presents difficulties, of financial magnitude, which at first sight appear insurmountable. The complex interests and divided authorities of this overgrown Metropolis oppose obstacles to municipal reform such as do not exist elsewhere; hence the smaller dimensions and more compact government of provincial cities render changes more practicable; consequently, Manchester, Liverpool, Glasgow, and smaller municipalities have reformed many things which remain a blot on the Metropolis. But, if we are to escape fire and pestilence, the time has arrived when London must abandon polluted sources for its drinking water, and adopt a service of constant high pressure. How is this to be accomplished? The case is especially difficult. Already a complete system of water-works exists, upon which nearly 12 millions have been expended. The enormous quantity of 120 million gallons supplied daily cannot be obtained from pure sources. Lakes and catchment basins are available for the great towns of the north, but London is too remote from any suitable gathering-ground. On the other hand, the present supply is ample in quantity, and generally suitable for all save drinking and culinary purposes. Allowing 2 gallons of pure water per head, 8 million gallons would suffice for the daily supply of the present population for dietetic purposes, or only one-sixteenth part of the present total supply, while the remaining 112 million gallons need no such high standard of purity. It is practicable to obtain the smaller quantity from absolutely pure sources; but it is unnecessary and financially impracticable to obtain the larger quantity with the same degree of purity. This proposition, of course, suggests a dual supply, as now proposed by the Metropolitan Board of Works, and as suggested in my Presidential Address before the Association of Municipal Engineers, at Birmingham, in 1874, where I said: "There was great waste in the purification of water not required for domestic purposes. Out of the 30 or 40 gallons of water per head supplied to the population, less than one-fourth is used for domestic or drinking purposes, the remainder being used for street-watering, sewer-flushing, and other processes which do not demand any degree of purity. The necessity for purification of water is confined to the 5 or 6 gallons per head required absolutely for domestic purposes. Such a distinction of supply would, of course, involve a dual system in every house. The reduction of the purified domestic supply within reasonable limits would greatly assist in the settlement of the sewage question by reducing the demands upon water companies, and bringing the standard of sewage purification within easily obtainable limits."

The scheme now propounded by the Metropolitan Board is, in my opinion, the best practicable way of meeting the enormous difficulties of the position; viz.—1. By placing the control of the combined works of water supply on a public footing. 2. By the introduction of a special pure and constant service at high pressure.

The advantages of unity of staff and management under public control, as compared with divided management, waste of water, inefficiency of public and private service, and a wasteful expenditure of between £100,000 and £200,000 per annum, needs no discussion. The necessity has been long acknowledged, and repeatedly officially recommended, since the time of the first General Board of Health in 1850.

With regard to the new sources of supply, it has been repeatedly shown that the basin of the Thames contains ample springs of most excellent quality. The Royal Commission of 1874 reported that, within fifty miles of the Metropolis, at least five times the present volume of water supplied could be obtained from springs.

The analyses of the waters at present supplied to London show that water from the chalk springs of the Kent Water Company is invariably distinguished from all other supplies by being lower in temperature, purer in quality, unaffected by animal or vegetable life, and needs no filtration; it is cool, sparkling, and palatable, and there is no evidence that chalk water is less healthy than soft water. By comparing the mortality of hard and soft water towns, it will be found that the one neither improves, nor the other lowers, the general health. London, with its hard water, has a relatively low rate of mortality. A large portion of the earth's surface consists of calcareous districts, and whole populations live upon chalk waters. The manufactures of the Metropolis are not such as to create a great demand for soft water, and the soap-saving question is much exaggerated. Soft water having disadvantages as well as advantages, there is not sufficient justification for discarding home supplies for new sources, at a great distance and at a large cost. The Royal Commission of 1874 report of the Kent water, "That the continued and extended supply of this and similar water to the Metropolis is very desirable."

The application of the foregoing argument supports the principles of the scheme propounded by the advisers of the Metropolitan Board, which scheme is thus stated: It is proposed to supply, by separate mains constantly charged, pure spring water, under high pressure, for potable purposes, to every house; to use the same mains, water, and pressure for the service of the hydrant jets, to extinguish fire; to provide on the high ground, to the north and south of London, four covered service reservoirs, holding enough for four days consumption.

For the purpose of supplying these, it is proposed to sink, in the great water-bearing strata in the country districts around London, wells and borings at distances varying from about 15 to 20 miles from the centre of the Metropolis, and by proper pumping-stations to lift the water from them into the four reservoirs. It is estimated for two sources of supply, and for two pumping-stations for each reservoir, making a total of eight pumping-stations, from which to derive the 16 millions of gallons per day.

These reservoirs would be 400 feet above Ordnance, and from each reservoir would proceed sets of arterial mains which would traverse the Metropolis, and be coupled so as to put all the reservoirs into communication.

From these arterial mains supply-mains would proceed along the streets, under the footway, at each side of the road.

It is proposed to fix, in each house, an air-tight pressure receiver, holding, according to the size of the house, from 2 to 10 gallons. This receiver would be placed in the basement, and close to the point of inlet of the service-pipe. It would have only one draw-off tap, from which the water would be taken, and when the receiver was emptied it would be so arranged as to fill up again gradually.

Such a scheme naturally involves the purchase of existing water-works; indeed, under any circumstances, this must be regarded as a primary condition, and if there be a dual system it must be under one control.

Several schemes have been proposed from sources which have since become largely contaminated. In 1850, the General Board of Health recommended that the present river sources should be abandoned, and a surface supply obtained from gathering-grounds on the Surrey sands, between Bagshot, Woking, and Farningham, which were estimated to yield 28 millions of gallons of soft water daily, but would require filtration to remove the infusion of peat; the remainder of the supply was to be obtained from the harder waters of the River Wey and its tributaries. The General Board only contemplated a total supply of 40 million gallons daily, whereas, at the present time, London consumes three times that quantity, and has quite outgrown the Surrey scheme. Catchment schemes have failed in dry seasons, while the great stores of subterranean waters have supplied the London rivers during the severest droughts.

Other schemes have been propounded, notably that of Mr. Bateman, in 1865, for bringing water to London from the sources of the Severn, at a cost of about £8,685,000 for the supply of 130 million gallons daily, or an ultimate supply of 230 million gallons, at a cost of £11,400,000. Messrs. Hemans and Hassard, about the same time, propounded a scheme for bringing 250 million gallons daily from the Lakes of Cumberland and Westmoreland, at a cost of £13,500,000. With present prices, both these estimates would have to be very largely increased, and it would be equally necessary to purchase the interest of existing works. Both schemes were gravitating, but neither would give a constant high-pressure fire service without the addition of pumping. The Royal Commission of 1869 report: "It is satisfactory to know that there exists, within easy reach of London, a supply of the best and purest spring water, which, in case of need, could readily be rendered available as an auxiliary source of water supply to the Metropolis, in quantities sufficient, at all events, for drinking, if not for other purposes."

The estimated cost of the scheme of the Metropolitan Board, including street hydrants and house-fittings, is 5½ millions, representing an annual charge on the metropolitan rates of a quarter of a million, or 2½d. in the pound. It is contended that, by the expenditure of this large sum, an "absolute saving" of £137,000 per annum will be effected, as compared with the cost of adapting the existing water-works, by increased pumping,

to give constant high pressure, alteration of house-fittings, fixing hydrants, and the cost of the contemplated extension of the Fire Brigade, which will be rendered unnecessary.

The cost of acquiring the existing works is estimated at £25,000,000, representing an annual charge of £875,000, or 8¾d. in the pound; adding the cost of the new scheme, £250,000 per annum, the dual scheme will, therefore, involve a charge on the rates of about £1,100,000, or 11d. in the pound. Against this is to be set off the revenue from such water-rates as the new governing body may impose. The total revenue of the eight existing Water Companies during the year ending December 31, 1876, was £1,292,589 14s. 2d., exclusive of more than half a million of balances brought forward. Therefore, on sanitary, financial, and practical grounds, a dual system, established on a public basis, recommends itself for adoption under the special circumstances operating in the Metropolis.

Whether either a new source of water or new works be adopted, the time has arrived when the existing works should be taken out of private management, and placed on a public footing. So important a matter ought not to be subordinated to mere private interests and trade purposes.

But the body which propounds the new scheme is not the governing body of the Metropolis. There is a "Greater London," which also requires pure water and protection from fire. The functions of the Metropolitan Board are not even conterminous with the area of the various Water Companies which it proposes to acquire.

London cannot afford to repeat the errors of the past by accepting any partial scheme which confines general advantages within artificial limits. The use of water is steadily increasing, and the question must be extended beyond the limits of the Metropolitan Board. So great a scheme must be identified with extended powers which shall embrace "London over the border." The great question of the consolidation of Municipal Government is beyond the province of this paper. It will be for the wisdom of Parliament to determine how the greatest good shall be enjoyed by the greatest number, but it cannot be tolerated that the "outer ring" shall be excluded from any vital scheme affecting them equally with the more limited area at present known as the Metropolis.

Whether the Metropolitan Board shall be extended or give place to a Municipality of London, or whether the water supply be confided to a special Commission, one condition is essential—viz., that the entire population which forms the aggregate of "London" shall participate in the advantages.

I therefore submit the following conclusions:—

1. That the river sources of the London water supply are hopelessly impure, and should be forthwith abandoned for dietetic purposes.
2. That the magnitude of London and financial considerations point to a limited supply of perfectly pure water for dietetic purposes, supplemented by the present sources for general purposes, as the most practicable method of dealing with the question.
3. That the new supply should be constant and at high pressure.
4. That the entire system should be under public control, and extended to the whole population of London.

In the discussion that followed,

Mr. Fowler (member of the Metropolitan Board of Works) asked if, supposing the new source suggested by the Chairman contemplated doing away with the present supply and the present works of the various Water Companies in the Metropolis.

The Chairman, in reply, said he thought, with some exceptions, the present works might be made available. Of course, in some instances, larger mains would have to be put down for fire protection.

Mr. Fowler said no doubt the distribution would be easy enough, but the point was, how would the water be brought from the Bagshot Sands to the various works?

The Chairman said one plan was to bring the water to Wimbledon for distribution from that point.

In answer to Mr. Eastman, the Chairman said the spring sources from whence the water would be derived would prevent any sewage pollution.

Mr. R. Attenborough, representing a local authority, said he would like to know whether the Ratepayers of the Metropolis would be compelled to buy up all the Water Companies at the enormous cost of £25,000,000, seeing that they could have purchased them up in 1851 for £6,000,000. He should think London could be supplied from Bagshot Sands for an outlay at the most of 12 or 15 millions. The Companies, by not carrying out the very conditions they 20 years ago obtained powers for, had lugged the ratepayers into a charge of 400 per cent. on their capital, if the scheme of the Metropolitan Board of Works were to be adopted. He believed every requisite in a pure and continuous supply could be conferred by the present Companies under the powers and conditions then existing.

Mr. Jones said he hoped the condition of the Ratepayers of London, which was now reduced to one of poverty, would be properly protected in any scheme which might be carried out. The Companies had not acted fairly in dealing with those from whom they demanded rates. His own water-rate was 30s. some years ago, but now it had gone up to £5 8s., and he supposed some profit was made when it was at the lower sum. The Metropolitan Board of Works, it seemed to him, permitted themselves to be twiddled round the fingers of their engineers, whilst they were sent as representatives for purposes of judicious legislation. He did not think it would be found there was a sufficient quantity of water to be got either from sand or chalk to supply the Metropolis; at all events, not water free from iron.

Mr. Baldwin Latham, C.E., said no man in his senses would recommend the ratepayers to go in for the scheme proposed by the Metropolitan Board of Works. If the Kent Company's water was so much superior to that of the Thames, the results, especially in a zymotic sense, in the districts supplied by the former should be much more favourable in comparison with those fed by the latter; but it was not so, and in support of that view he read statistics. He did not agree with the plan of collecting the water from Bagshot Sands, and distributing it in the metropolitan area, because it was well known by engineers who, like himself, had made experiments upon the subject, that whenever the waters in the springs were low it was a fever year, and when they were high it was a healthy year throughout the country.

Dr. Tidy said there could be no question that, in the districts served by the Kent Company's mains, zymotic diseases were more prevalent than in those supplied by water from the Thames. The results which had been paraded in the sixth report of the Rivers Pollution Commission about sewage contamination were not, he contended, those of chemical analyses, but of investigations of a different character altogether. When they were having a water supply more pure and uncontaminated than ever, were they to adopt new schemes which, in his opinion, were unnecessary? He had no interest in the Water Companies himself, but he did not recognize the necessity for the immense expense to which the Metropolitan Board of Works proposed to go.

Mr. Angell, in replying, said the water which the people of the Metropolis drank should be pure, and should be procured from pure sources, and that was the great principle to be studied, whatever their individual views—differing as they did in many important points—happened to be. The purest water would give the best health, and the whole matter was one which would have to be fought out before the public, with the best evidence which could possibly be obtained; and he did not think Government would allow the various Water Companies to be suppressed, if they were to be suppressed, without their fair and proper value being paid.

Votes of thanks to the Chairman, and to Mr. Angell for his paper, closed the proceedings.

EUROPEAN GAS COMPANY, LIMITED.

An Extraordinary Half-Yearly General Meeting of this Company was held at the London Offices, Austin Friars, on Wednesday, the 16th inst.—W. White, Esq., in the chair.

The Secretary (Mr. Henry Dozell) read the notice convening the meeting, also the following report by the Directors:—

The political state of France during the past six months has adversely affected the interests of the Company, preventing, in some cases, the usual increase in the consumption of gas, but notwithstanding this unfavourable state of affairs, the business of the Company has been well maintained in the aggregate, and has even exceeded that of the previous year at several stations.

At Rouen many of the cotton manufactories have been working full time, and that branch of industry appears to be specially prosperous, whence a considerable increase of consumption of gas has taken place at that station.

At Boulogne many new gas consumers are now supplied, not only for lighting, but for cooking and heating. It may be remarked that the use of gas for such purposes is now being more rapidly developed at other stations of the Company also, than at any previous time. Much, however, yet remains to be done, and a large field may be found for future extensions. Every encouragement is offered by the Board to bring this into operation as quickly as possible.

At Caen the variations in trade are generally less severely felt than at other stations, and the past year has not proved an exception to the rule; but at Havre business has been remarkably dull, and such economy has been practised by the inhabitants that during several months the quantity of gas sold did not attain the same amount as in the corresponding period of the previous year.

At Nantes, Amiens, and Bolbec, nothing requiring special notice has occurred, but in some cases the Board have considered it prudent to meet the difficult circumstances of the time by reducing the price of gas and making extra allowances, within such limits, however, as not materially to affect the Company's revenue.

The Directors regret to state that the value of coke has seriously diminished, owing to the continued mild weather which still prevails. Large stocks have been accumulated, notwithstanding repeated reductions of price, and the loss and deterioration from stacking considerable quantities are matters of importance.

Should the temperature, however, be more seasonable, during the remainder of the winter, it is possible that this unfavourable state of affairs may assume a more satisfactory aspect.

The Board of Directors have the pleasure to state that, since the last change of Ministry in France the general trade of the country has become more active, and should this revival prove permanent, of which the prospect appears promising, the results of the current year, when the accounts are made up to the 31st of March, may yet show an amount of net earnings equal to that recorded for the financial year 1876-7, when a considerable balance remained after paying the usual dividend.

Debentures to the amount of £18,100 came to maturity on the 1st inst., £5900 of which were bearing 5½ per cent. interest; £11,400, 5 per cent.; and £800, 4½ per cent. These have all been renewed or replaced at 4½ per cent.

The usual interim dividend for the half year, at the rate of 8 per cent. per annum, will be paid on the 1st of February by means of warrants to be forwarded to the shareholders on the previous day.

The Chairman: Gentlemen, I think I need hardly remind you that we, as a Company lighting towns in France, have been passing through rather difficult times lately, and I think those difficult times have been quite sufficient to account for the fact that the report just read is not quite so bright as others which have preceded it. From May to December last the fate of France appeared to be, as it were, hanging in the balance. Commerce was paralyzed, and the effect of this continued state of things was distinctly felt at our various stations. Happily a favourable change has occurred, and the present Government seems to inspire greater confidence in its permanency than that which has passed away. With reference to coke, we thought it necessary to deal at some length in the report with this residual, because, as we have stated, we have been obliged to make continual reductions in the price, in order to keep our stocks down as much as possible. If Providence would only allow us to have three or four weeks of cold weather, we should be placed in a very different position, and if such weather would come at once it would suit us very much better. You will observe that we refer also in the report to several reductions that have been made in the price of gas. Those reductions have been conceded to enable us to retain customers who otherwise would have escaped us. I do not think it desirable to go into this question at greater length, as it involves some considerations of great delicacy; but those deductions will be perceptible in our returns at the end of the year, as they may not be covered by the increased consumption which they were intended to produce, so we think it desirable just to call your attention to them. With regard to tar and ammoniacal liquor, we have been doing moderately well, and have no reason to complain. With reference to coals, we have nothing to add to that which we have previously reported to you. The favourable contracts we made some time ago, both for coals and freight, have been duly carried out, and we have good reason to be satisfied with them. While the trade of all countries has remained in so depressed a state, we can hardly expect that that of France should be restored to its former activity, and though it is still better than that of many nations, it does not yet seem sufficient to render any large increase in the use of our commodity—that is, gas—probable. Such being the case, the outlay for extensions will be limited, and for the present we do not see our way to engage in any additional works other than those of which you have already been made aware. At several of our stations we have availed ourselves of this quiet interval to overhaul the mains and bring them into a state of full efficiency. The cost of such undertakings is, however, borne by revenue, except in cases where larger mains are laid to supply increased business. You will see by the report that we have reduced the charge for interest on debentures, by replacing at 4½ per cent. those at a higher rate, which came due on the 1st of this month. I think this is another proof, if one were wanted, of the very high estimation in which the securities of this Company are held by the public. I have already stated as much as I consider it prudent to say respecting future prospects, which depend upon the revival of trade and the state of the weather. I can only say in addition that we clearly see our way to hold our own, and to be ready to provide for the improved state of business, which we believe must come sooner or later. Having now touched upon those various points, which, no doubt, are of most interest to you, I will move—"That the report just read be received and adopted;" and, this having been seconded, I shall be ready to hear any remarks which may be made on it, and to answer any questions which may be addressed to me on the affairs of the Company.

Mr. Chaloner Smith seconded the motion, and no one rising to address the meeting, it was at once put and carried.

On the motion of Mr. Stokes, a cordial vote of thanks was given to the Chairman and to the Directors for their continued attention to the interests of the Company.

The Chairman acknowledged the compliment. He said: On behalf of myself and brother Directors, I have to thank the Shareholders for the vote they have just passed. Though it is so often repeated, something like twice a year, still it is an encouragement to your Directors to go on doing the best they can for the Company. We like to live in the confidence of our Shareholders, and it is my privilege, and that of my brother Directors, to think we do so.

The proceedings then terminated.

PARA GAS COMPANY, LIMITED.

The Ordinary General Meeting of Shareholders was held at the London Offices of the Company, Union Court, Old Broad Street, on Thursday, the 17th inst.—JAMES BRICKWELL, Esq., in the chair.

The SECRETARY (Mr. T. S. Borradaile) read the notice of meeting, and the following report and statements of account were presented:—

The Directors have the pleasure of submitting to the Proprietors the Statement of Accounts and Balance-Sheet of the Company for the half year ending the 30th of September last. The result, as shown by the Revenue Account, is a profit for the six months of £3531 6s. 4d., after providing for all bad and doubtful debts.

The falling off in the revenue obtainable from private lighting is the point most to be noticed in this result, and the Engineer and Manager (Mr. Louis Penny) states that this is due principally to the reduction in price lately made in petroleum, which can now be purchased at 1s. 6½d. per gallon, a cost that induces some, and compels the poorer class of consumers, to use this cheap illuminating agent instead of gas. This loss, however, is somewhat neutralized by the improvement in the revenue from public establishments, which improvement arises from the Barracks and other Government buildings having been fitted for, and using gas.

A large theatre in the town of Belem is now in the course of completion, and it is expected that this will prove a fresh source of revenue to the Company. The necessary sun burner, chandeliers, &c., &c., have just been despatched from Liverpool for this building.

The general trade, and consequently the financial position of the town, has in no way improved during the last twelve months, and until some revival takes place it must be expected that strict economy will be the order of the day, and the use of gas deemed almost a luxury.

The low cost of coals and freight has been again in favour of the Company, of which the Directors have taken every advantage. The Newcastle gas coal lately shipped by the Company having been favourably reported upon by the Manager, the Directors have secured their supplies in advance for the current year on what are deemed to be very satisfactory terms.

An interim dividend was paid by the Directors (in accordance with the powers vested in them) in June last, at the rate of 3 per cent. per annum, and they now recommend the declaration of a dividend at the rate of 5 per cent. per annum for the half year just closed, thus making a total dividend of 4 per cent. per annum for the twelve months ending on the 30th of September last, and carrying forward a balance of £1106 4s. 5d.

The letters and reports from the Manager are quite satisfactory, and the works continue to be maintained in a thoroughly efficient condition.

Two of your Directors—namely, Mr. Thomas Clarke Tatham and Mr. James Brickwell—retire by rotation, but are eligible for re-election, and offer themselves accordingly.

Mr. Philip Crellin, the Auditor of the Company, likewise retires from office, but, being eligible, also offers himself for re-election.

Dr. General Balance-Sheet, for the Half Year ending Sept. 30, 1877. Cr.

Authorized capital		£175,000	0	0	Works, including extensions, furniture, &c.	£142,824	0 2
Less not taken up		8,130	0	0	Gas-fitting capital on March 31, 1877	11,122	13 8
		£166,870	0	0	Extensions to date	69	18 6
Debenture loan		5,000	0	0	Value of stock in Pará	3,559	1 7
Fire insurance-fund		834	11	11	Lighter capital	1,732	14 11
Bills payable		772	5	11	Stores	2,037	1 7
Sundry creditors in London		320	8	11	Coals	4,137	12 5
Ditto in Pará		343	14	6	Sundry debtors in Pará	8,790	15 5
Gas-fitting rental reserve-fund to March 31, 1877. £493 14 5					Mauá and Co. (in suspense)	112	14 9
Add reserve for the current half year, less expended in repairs	110 16 8				Cash at Pará bankers	1,654	7 0
		604	11	1	Ditto Glyn and Co.	440	3 10
Profit and loss account		5,277	19	5	Petty cash (London)	7	7 11
					Bills of exchange, in hand	3,535	0 0
		£180,023	11	9		£180,023	11 9

Revenue Account.

Coals & wood for carbonizing		£3,185	4	0	Public lamps, &c.	£5,789	3 5
Wages, including lamplighting		2,038	6	1	Private lights	3,110	17 9
Salaries		821	6	10	Public establishments	355	1 11
Sundry charges		61	0	2	Illuminations	39	4 7
Retorts		46	4	6	Fittings-rental	115	3 7
Repairs		308	15	9	Meter-rental	197	13 10
Office expenses, stationery, &c.		117	11	2	Lighter revenue	213	10 6
Law charges		89	10	5	Coke	1,151	0 7
Gas-fitting revenue and expenditure		669	13	6	Tar	100	11 9
Interest and discount		22	19	10	Rent and taxes	134	10 4
Debenture interest		150	0	0	Exchange	223	16 4
Directors fees		300	0	0	Transfer fees, &c.	1	17 6
Travelling expenses		90	13	6			
Profit and loss		3,531	6	4			
		£11,432	12	1		£11,432	12 1

Profit and Loss Account.

Interim dividend declared		£2,503	1	0	Balance brought forward from March 31, 1877	£4,335	2 4
Bad debts to this date	£103 6 2				Revenue account (profit)	3,531	6 4
Less recovered during the half year	17 17 11						
		85	8	3			
Balance carried forward		5,277	19	5			
		£7,866	8	8		£7,866	8 8

The CHAIRMAN, in moving the adoption of the report, said although the Directors were able to show a certain amount of improvement in their accounts, they regretted to note that the improvement had not arisen from a better condition of trade in Pará. In truth, if any change at all had taken place in that respect, it was rather in a backward direction than otherwise, and probably it was hardly possible for business there to be worse than it was at the present moment. This fact must also be taken in connection with the circumstance that the Company had a strong antagonist in the consumption of petroleum for lighting purposes, which could now be purchased at so low a price that its general use was readily accounted for. The success of the Company resulting from last year's operations, and, particularly during the last six months, was mainly attributable to the advantage derived from the low price of coal. He believed the price had not exceeded something like 7s. 3d. per ton f.o.b. at Newcastle for first-class coals. Freights also had been extremely favourable, not exceeding 15s. or 16s. per ton. The Directors had been so well satisfied with the character of the coal sent out (in which satisfaction their Manager in Pará shared), that they had entered into arrangements, at a somewhat less price, for another year's supply, although their present stock at the works would probably not all be carbonized before the month of August next. They had not been able to secure freights on equally eligible terms; but they had instructed the Secretary, who was well versed in shipping matters, to take advantage of the most reasonable offers he could obtain. While the cost of coal had been favourable, the value of coke had unfortunately been depreciated; but the Manager had entered into arrangements with the small steamers which plied to Pará, and so had got rid of considerable quantities at fair prices, which had enabled him to keep up the ordinary price in the town. Although, therefore, the item of coke in the accounts was not quite so good as on the last occasion, the deficit was not very great.

The SECRETARY said the reduction upon last year was about £90.

The CHAIRMAN said it was satisfactory to know that the financial position of the Company in Pará had much improved. Their relations with the Government were considerably better, and the public accounts were now settled up much closer than they had ever previously been. In past times the Company had suffered frightfully from the infliction of fines, in consequence of regulations which might almost be said to have been unjustly adopted at Pará. The Manager had shown such good diplomacy in this matter that he was now enabled almost entirely to avoid these continuous fines, which were often inflicted without reason, and which amounted to considerable sums of money. Looking at all the circumstances of the Company, he (the Chairman) thought he could safely say that all they needed was a revival of trade. If that could be secured their affairs would become more prosperous. It was a satisfaction to the Directors that the profit and loss account now presented was somewhat better than the last; and that, taking the whole year, they were enabled to pay the Shareholders dividends at the rate of 4 per cent.

Captain CLARKE seconded the motion.

Mr. H. P. STEPHENSON called attention to the gas-fittings capital, which he said amounted to nearly £15,000, while the annual expenditure on gas-fittings, according to the profit and loss account, was nearly £1300. He wished to know whether it was likely that this large expenditure would be maintained. He was quite aware that the present Directors inherited the legacy of gas-fittings, in the capital account, from their predecessors at the Board, and what he wished to suggest was that they should take into consideration the question of the desirability of increasing the charge for gas-fittings rental, which appeared to be so inadequate.

The CHAIRMAN said he was glad that reference had been made to the matter. The suggestion just thrown out was quite in accordance with the views of the Directors, but he feared it could not be adopted.

The SECRETARY read extracts from the Manager's report, in which he expressed an opinion that any additional charge in that way would be prejudicial to the interests of the Company, by causing a reduction of consumption.

Mr. WILSON agreed in the opinion expressed by the Manager, and argued that the policy of the Directors should be to reduce the price of gas, so as to bring it more fairly into competition with the use of petroleum for lighting purposes. He thought if they had adopted that course years ago, as he recommended, the consumption of gas would now be very much larger than it was, and the Company would have a firmer hold upon the public of Pará than they appeared to have.

The CHAIRMAN said he had no hesitation in asserting that, if the course recommended by Mr. Wilson were adopted, the shareholders would have no dividend at all.

Mr. WHITE was disposed to coincide to a great extent with Mr. Wilson in thinking that, by gradually reducing the price of gas, it would benefit the Company. As a Director of several Companies, he could say, from experience, that in almost every case reductions recouped themselves in a few years. Referring to the first item in the revenue account, he asked whether the Board were satisfied that there was any advantage in carbonizing wood.

The CHAIRMAN said, if they carbonized Newcastle coal alone, they would have much more coke than they could possibly get rid of. It had been found that it was more economical to carbonize wood and coal together. If there had been a good market for coke it would be otherwise.

Mr. WHITE said he could not conceive that there was any economy in making bad gas from wood, and then bringing up the quality by the use of expensive coal.

Mr. HENRY, alluding to the circumstance that the present meeting was delayed for some time for want of a sufficient attendance of Shareholders, suggested that the Directors should give notice to alter the Articles of Association, so as to reduce the quorum from 20 to 10 members.

The CHAIRMAN promised that all the suggestions made by the Shareholders should receive the attention of the Board.

The motion was then put and carried.

A resolution declaring the dividend recommended in the report was adopted, and the retiring Directors and Auditor were re-elected.

Votes of thanks were given to the Chairman and Directors, also to the Secretary and the other officers of the Company, and the Chairman and Secretary having acknowledged these compliments for themselves and colleagues, the proceedings terminated.

PRESTON GAS COMPANY.

The Half-Yearly Meeting of Shareholders was held on Monday, the 18th inst.—Lieut.-Col. BURCHALL in the chair.

The following report was submitted:—

In presenting to the Shareholders the accounts of the Company for the year ending the 30th of November last, your Directors would observe that their anticipations of the effect which would be produced by the recent reduction in the price of gas have been verified, but not exceeded. The decrease of revenue for the year from that cause may be set down at £2600.

The increasing consumption of gas, which for the past year has amounted to 9 million cubic feet, gives reason to hope that this deficiency will be made up at no very distant date.

Another charge upon revenue has been produced by the transference from capital to revenue of a sum of £1500, which your Directors estimate as the value of the office in Glover Street, now closed in consequence of the completion of the new offices.

Considering these reductions to be merely exceptional and temporary, and the prospects of the Company being generally satisfactory, your Directors feel justified in again recommending the usual dividends of 10 per cent. per annum on stock A, and 7 per cent. on stock B. To carry out this recommendation, it will be necessary to resort to the reserve-fund, but it will be to the extent of £692 only.

The manufacturing plant at the Walker Street station, which has been undergoing considerable improvements, is now in full and satisfactory working condition. The storeage for coal and coke at that station is dependent upon the closing of Appleton Row.

Your Directors hope shortly to obtain the necessary powers for accomplishing this object, and the area required will then be appropriated.

The whole of the stock B allotted in 1872 has now been called up. The sum of £33,000 still remains to be allotted.

The CHAIRMAN, in moving the adoption of the report, alluded to the satisfactory increase in the consumption of gas, and the desire of the Company to give the public every benefit in price and quality. He stigmatized a recent complaint in the Council of the impurity and deficient illuminating power of the gas as unjustifiable, as the gentleman making it was at the time in possession of the official report of the Surveyor of the Local Board that, both in quality and brilliancy, the gas was above the legally required standard. In many instances complaints of deficient brilliancy had been removed by the gas-fittings being cleaned, or the delivery-pipes enlarged. Attention to these points was necessary, as the pressure was now greater. With clean and larger pipes, and a modifying stop-cock, consumers would ensure greater illumination, and prevent the vitiated atmosphere caused by the escape of unconsumed gas. The attention of the Directors was unremitting to secure purity in manufacture.

The report having been adopted, the usual dividend was declared, and the Directors whose term of office had expired were reappointed with applause.

The meeting, after electing Mr. Davis as an Auditor, separated with the usual vote of thanks to the Chairman.

INSTITUTION OF CIVIL ENGINEERS.

The first Meeting after the Christmas recess was held on Tuesday, the 15th inst., when the newly elected President, Mr. JOHN FREDERIC BATEMAN, F.R.SS.L. & E., delivered an Inaugural Address.

After a passing allusion to the growth of the Institution, which at the end of 1844 numbered only 552 of all classes, now increased to 3189, reference was made to some of the addresses of the 18 gentlemen who had previously occupied the presidential chair, mainly for the purposes of comparison. Thus, Mr. Robert Stephenson, in summarizing the statistics of British railways to the end of 1854, mentioned that 368 millions sterling had been authorized to be expended, of which 286 millions had been raised; whereas at the end of 1876 these figures were respectively 742 and 682 millions. Again, Mr. Locke, in treating of French railways, remarked that at the close 1856 concessions had been granted for 7030 miles, of which 4060 miles were open; whilst at the close of 1876 these mileages, were 16,452 and 12,715. Mr. M'Clean had contrasted the income available for taxation in 1815 with 1856, and had shown that in the interval the revenue from land had not increased, while that from houses had augmented 300 per cent.; and from quarries, mines, iron-works, canals, railways, &c., 1200 per cent. There was evidence that since 1856 the increase had been very great, even if these high rates had not actually been maintained. These remarks showed how largely the Engineer had been employed, and how much his labours had contributed to the development of the wealth and prosperity of all countries where he had been engaged.

Proceeding to matters more personal to every member of the Institution, the President urged that engineering was, in fact, but the embodiment of practical wisdom; or, in the words of Bacon, "the conjunction of contemplation and action." Thought combined with practice had led to the perfecting of the steam-engine by James Watt, to the successful application of the locomotive engine by George Stephenson, and to the production of the electric telegraph. It was to the combination of sound theory with successful practice that engineering owed its present position, and had been able to advance material prosperity. It might, however, lay claim to more than that, for the works of the engineer had carried the blessings of civilization into every quarter of the globe; the steam-engine, in its various applications, had knitted together the most distant nations, ignorance had been brought into contact with knowledge, and heathenism with Christianity. On these grounds, and on others, the education of the engineer was of serious moment. In France, and on the Continent generally, where public works were mainly carried out by the Governments, engineers were educated in special schools, the theoretical information thus acquired being admittedly superior, as a rule, to that imparted in this country; yet the students lacked that practical experience which had hitherto been the main source of the success of the English engineer, who owed little or nothing to Government patronage, and whose employment depended on individual merit, the works being undertaken by private enterprise. Still, our young engineers were not always prepared, by preliminary education, as well as they might be for the subsequent acquisition of practical knowledge. Special qualifications, and some of a high order, were required, and it would be well if advantage were taken of the numerous public schools in which instruction bearing on engineering was given, with a view to prevent young men becoming pupils without these qualifications. But it must be understood that such training could only be regarded as preparatory, and not as being complete in itself; and it was a mistake and mischievous where any college or school professed to fit a student to act at once as an engineer.

The President then gave a brief description of a few of the principal engineering works recently completed, or at present under construction; mentioning, in telegraph engineering, the telephones of Mr. A. G. Bell and Mr. Edison—instruments which differed in construction, but by both of which the human voice, with all its modulations, could be transmitted to great distances. Then again, the quadruple system of telegraphy, imported from America, had also come into use. By this system two messages could be sent in each direction by the same wire at the same time. During the past year electricity had put forward other claims than those relating to means of communication. Thus, the electric light, if it could not at present compete successfully with the convenience in domestic arrangements of gas lighting, had been found useful and effective for the illumination of large spaces, and the invention was about to be applied at the Lizard Point Lighthouses.

In the conviction that experience of a special kind, gained during a long professional life, was of more real value than allusions, however lucid, to a variety of subjects, the President next adverted to a question which was of the highest importance in that branch of the profession to which his attention had been more particularly directed—viz., the rainfall of this country, and the quantity of water which flowed off the ground, available for the use of man if properly utilized, or destructive when uncontrolled and permitted to cause floods or torrents. The variation in the rainfall was very great. For instance, on the east coast of England and Scotland the average did not exceed 20 inches per annum; on the south and west coasts it was 35 or 40 inches; in the Penine chain of hills, forming the backbone of England, the quantity ranged from 40 to 60 inches; in the highest parts of Wales, Cumberland, and Westmoreland a fall of from 60 to 80 inches was reached, while in some parts of the Lake districts it amounted to upwards of 150 inches. The observations of Mr. J. F. (afterwards Dr.) Miller, of Whitehaven, showed that the maximum density of the rain cloud was at about 2000 feet above the sea level, although local circumstances exercise an important influence upon the quantity of rain which really reached the earth; that the greatest deposition of rain might be expected on that side of a mountain exceeding 2000 feet in height, upon which the rain cloud impinged, but on the opposite side when the mountains did not rise so high; and that in a succession of ridges and valleys, without intervening mountains of sufficient height to arrest the progress of the rain cloud, the greatest fall of rain would be in the first trough. In illustration, numerous observations on the rainfall in Lancashire and Yorkshire were given; and it was mentioned that the same results were observed in the Lake districts of Dumbarton, Stirling, and Perthshire. As the quantity of rain varied in every district, and depended not only upon elevation but upon the physical and geographical features of the country, nothing could be more fallacious than to attempt to determine, by any fixed ratio, the amount of rain which would probably fall in any district, unless there were some corresponding one—similar in elevation, in proximity to the sea, in exposure to wind, and in other external circumstances—with which to compare it. The proportion of this very varying rainfall which would flow off the surface depended largely upon the geological character of the rocks, their elevation and declivity, and the manner in which they were clothed with vegetation. The water passed off partly in floods and partly in perennial springs; that issuing from springs varying according to the physical features or lithological character of the district. Absorbent rocks yielded the greatest abundance; next, loosely stratified rocks; and least of all, the closely bedded slate rocks and the primitive formations. Generally, in the coal measures, the millstone grit, and the primitive formations, the quantity of spring water in the driest seasons would vary from about one-quarter to three-quarters of a cubic foot per second per 1000 acres; one-half a foot per second per 1000 acres being an average quantity in a dry season. This quantity formed, however, but a small portion of that flowing off the ground in times of flood, which exceeded 500 or 600 to 1000 times the quantity of water in dry seasons. The amount of flood waters was an important consideration in all engineering operations, as upon it depended the supply of large storeage reservoirs, for canals, for water power, and for the use of towns; the openings of bridges spanning rivers, the construction of river courses, the drainage of lands, and the effect in "scour" upon the beds of rivers and upon the mouths of harbours.

MIDLAND ASSOCIATION OF GAS MANAGERS.

At the First General Meeting of the above Association, held at the Midland Hotel, Birmingham, on Thursday, Jan. 10, the following Inaugural Address was delivered by the President, Mr. CHARLES HUNT:—

Gentlemen,—It devolves upon me to say a few words, as appropriate as may be to the occasion which has brought us together, although, in doing so, I fear lest I may exhibit you as models of patience, rather than prove myself worthy of the privilege with which you have honoured me.

In the first place let me congratulate this meeting upon the very rapid progress made by the Association, for although, as yet, only three months old, it already numbers thirty members, a result which goes far to justify the most sanguine expectations which may be formed as to its future. On the threshold of this future, it may be well for us to consider what are the objects we intend to pursue.

Since the humble beginning made by Murdoch, in yonder factory at Soho, the history of gas lighting has been one of continuous development, so that now our industry finds employment in nearly every quarter of the globe. Regarded at first with scant favour, its manufacture looked upon as a highly mysterious occupation, more enlightened views have long since prevailed, new uses have been found for it, and the transference, in many conspicuous instances, of the duties and responsibilities of its supply into the hands of Municipal Authorities, may be fairly regarded as sufficient proof, if no other existed, that coal gas is looked upon at the present day as a public necessity.

The important position which it has thus acquired might be thought by some to furnish satisfactory evidence of a corresponding progress in its manufacture; but such does not appear to be the opinion entertained in many quarters, if we are to judge from the frequent admonitions addressed to us to put our houses in order. We are repeatedly told, both by Parliament and the public, that we do not supply gas either good enough or cheap enough; our own familiar friends turn round upon us, and accuse us of having "degenerated;" while—unkindest cut of all—from across the Channel has lately come to us a notice to quit the fair field of our labours so soon as our would-be successor shall have completed his arrangements for entering into possession of it. Under these, or indeed any circumstances, what can gas managers do better than unite their scattered forces, and consult together as to the best means to be adopted for the protection and advancement of the interests entrusted to their care? In forming this Association, we are but following the example set us by our professional brethren in all parts of the kingdom, still retaining undiminished our attachment to the parent Association, the labours of which, during the past sixteen years, in the promotion of a spirit of inquiry, and in the spread of information, have conferred infinite benefit upon gas manufacture. It is to be hoped that the day is near at hand when it and other kindred Associations will receive from those who, after all, are the chief gainers by them—namely, Gas Companies and Corporations, a yet more ample recognition than has hitherto been accorded to them, gratifying though this may be, for assuredly they fully deserve it.

During the past year or so the electric light has attracted considerable attention in France, where it has been applied for illuminating large buildings and open spaces; and opportunities are now afforded us for examining in this country its claims to public favour. There can be little doubt that much progress has, of late years, been made by way of perfecting its application, and the efforts of electricians have been partially successful in dividing the current of electricity, so as to produce, from the same source, a limited number of lights, or candles, as they are termed; but it is difficult to conceive that gas shareholders or corporations have anything to fear from it as to the value of their property, so long as it lacks so conspicuously that power of adaptation to varying requirements, the possession of which has contributed so powerfully to the success of the system of gas lighting.

Competition, to a limited extent, we may very likely experience in the immediate future; but there is room for both systems, and, if the rivalry so induced should act upon us as a stimulus to further exertion, by way of cheapening and extending the use of gas, it will by no means be a matter for regret.

We are, indeed, spurred on to such exertions by a variety of motives. Parliament, in its wisdom, has thought fit, during the last year or so, to adopt a new principle in gas legislation, by imposing upon some of the metropolitan, and also upon a few provincial companies, a sliding scale of dividend, so that henceforth the amount of this latter will depend in their case, to a considerable extent, upon the selling price of the gas. Thus a sort of speculative element is introduced, or payment by results, as it has been termed, which would appear to operate to the advantage alike of both buyer and seller; but originating in a doubt, believed, by some at any rate, to have been ill founded, as to the *bona fides* of the Companies, it seems not unlikely to prove of greater benefit to them than to the consumers, in whose interest especially the proposal was framed. In fact an abnormal condition of things, such as was the late coal famine, during the existence of which the new regulations would, in all probability, operate in favour of the consumer, can never be lasting, and must always be far outweighted by succeeding years of comparative tranquillity.

In another direction Parliament is likely to be more successful in limiting the profits of the Companies, for by the auction clauses now generally inserted in new Acts, the Shareholders are deprived of the premiums on fresh issues, while, at the same time, the question as to what is a fair dividend on gas capital, respecting which the decisions of the Legislature have been anything but consistent, is practically referred to the investing public, who may be relied upon to settle it to their own satisfaction, and, let us hope, to that of all other interests concerned. It would seem that the creation of non-dividend bearing capital, amounting practically to a reduced charge for dividend on all future issues, must tend ultimately to strengthen the position of the Companies, while the benefit to the consumer will prove immediate in its effect.

Cheap and pure gas being the desideratum, what can we do more than has been done in the past to further its attainment? We have been told very recently by Mr. Livesey (than whom no one can be more devoted to the interests of his profession) that gas manufacture, since its commencement, has not made the same progress as other manufactures, and he attributes this in a great measure to the absence, in the case of gas managers, of any direct pecuniary interest in the success of their several undertakings. A similar opinion has likewise been expressed by Mr. Bennett, in the paper which he read last June at the meeting of the parent Association, and what he says upon the subject, as coming from one who is not himself a gas manager, deserves our serious consideration. Mr. Bennett, indeed, does not hesitate to express his conviction that a much more extended and profitable business is likely to reward the efforts

of those who take the pains to seek it, and there must be many who think with him. While, however, agreeing cordially with much that has been advanced by both gentlemen, I feel by no means convinced of the soundness of their conclusions as a whole; or that gas managers, as a rule, deserve all that has lately been said of them. There is no doubt that competition and self-interest form two most powerful motives for exertion, but can it be said that either of them has been absent or untried in our case? Competition, for instance, existed until recently in almost all our largest towns, but it is not apparent that any one of them has ever been able to boast of having distinguished itself by any special progress in the art of gas manufacture, nor is it by any means clear that the amalgamation of the undertakings has in one single instance proved detrimental to their development. In London, until about 1860, competition existed in its most virulent form; but was the period immediately preceding 1860 noted for anything more famous than the establishment of the Great Central Gas Company, the natural outcome of the wasteful systems which then prevailed; and is it not a fact that the districting arrangements, by which at length competition was put an end to, have proved of the greatest possible benefit alike to Shareholders and Consumers? Those who, being dissatisfied with our present rate of increase, are casting about for a cause for it, will hardly find one to their liking in the entire absence of competition at the present day; competition between gas undertakings has been tried and found wanting.

Probably we are all agreed with Mr. Livesey that gas managers ought to be sharers in the wealth they help to create, and, in the absence of such participation, it is not surprising that they are occasionally wanting in that absorbing interest in their profession, often to be found in other branches of industry. There can, I think, be little doubt that the general adoption of a system of payment by results would prove advantageous all round, and there can but be few who would not welcome such a change; but the difficulties in the way of its adjustment are great, although, probably, not insurmountable; and it is to be observed that, while justifiable solely from a commercial point of view, the commercial aspect, pure and simple, is fast disappearing from gas undertakings, through their absorption by local authorities.

Notwithstanding, however, the absence, as a rule, of any such special motive for exertion, so abundant is the evidence of a general spirit of inquiry existing amongst them, isolated though they be, that it is impossible to say of gas managers as a body that they are not keenly alive to the interests of their profession, nor as zealous and energetic in the service of their employers as any set of men can possibly be. Whatever may be the reason for the apparent want of progress exhibited in our art since its infancy, it is hardly to be ascribed to the supineness or indifference of those whose daily occupation it has formed. Nor can it be attributed to any lack of interest on the part of scientific men and others outside the profession, for numberless have been their efforts to improve us, as the records of the Patent Office bear witness. Every few years has brought out a succession of new schemes, or old ones revived, the names of which, still living in our memories, are all that remain of once promising inventions, for few indeed have passed beyond the experimental stage, and all, without exception, after lingering for a while in the speculative regions—too often speculative in more senses than one—have disappeared, serving no other purpose, it would seem, than to show how utterly incorrigible we are.

Nevertheless, the demand for coal gas as originally distilled, condensed, purified, and distributed, has gone on increasing, until its supply has become the gigantic industry we now see it. Are those who have devoted the best part of their lives to its development not entitled to any credit for the enormous proportions it has assumed, and are not the failures to which I have referred to be attributed, in some degree, at least, to something inherent in the nature of the thing striven for? Is it nothing to have reduced the selling price to about one-fifth or one-sixth of what it was originally, thus bringing what was formerly a luxury to within the reach of the humblest in the land, and to have achieved this result without the aid of any material alteration in the process itself, a process which has, over and over again, been demonstrated to be, in its main features, unalterable? Whatever science may yet have in store for us—and she can by no means have exhausted her aid—the rise and growth thus far of the system of gas lighting will remain an enduring monument to the skill and energy of our predecessors.

If, however, science has been less active on our behalf than for others; if some amongst us, conspicuous for talent, have found in other pursuits that field for their ingenuity which appeared to be denied them in our own, at least we can say that assistance of a very substantial nature has not been wanting to us. Thrift is the good genius whose help in the past has materially contributed to the prosperity of gas undertakings, by lessening the cost of production; and it seems not unlikely that in the future the most solid success will still reward those who continue to invoke her aid. Although many degrees removed from the waste which at one time was deemed to be unavoidable, much remains to be accomplished; as is made evident, for example, by a comparison of the total weight of products accounted for with the original weight of coal submitted for distillation. It is no exaggeration to say that the loss of gas, through pressure unwisely permitted at the moment of evolution within the retorts, and by leakage through defective distributing plant, amounts to from 15 per cent. of the total quantity generated in the best managed concerns, to 30 or even 40 per cent. in those which are less efficiently conducted. So large an amount of valuable illuminating matter lost to the world demands from us our best efforts for its recovery; for this is surely a "consummation devoutly to be wished" for, and, viewed in the light of past experience, by no means hopeless of attainment. The late Mr. Esson, of Cheltenham, long ago set us an example of what could be achieved in the way of improved carbonization by relieving the retorts of the pressure caused by the dip-pipes, and I trust that at some future meeting his successor, our esteemed fellow-member, Mr. Paterson, may be induced to relate to us his experience in this direction. At the same time, signs are not wanting to show that those who have already succeeded in reducing their per centage of unaccounted-for gas to a moderate 6 or 7 per cent. are by no means disposed to "rest and be thankful;" so that we may fairly believe that the time is approaching when we shall be able to account on the right side of the balance-sheet for all but an insignificant portion of the entire weight of coal delivered into the retorts.

On the subject of retorts, it is to be observed that machinery has lately been adopted in their manufacture, and it is claimed that not only is the cost thereby lessened, but that, being rendered more dense, the durability of the article is improved. On this latter point our experience is, perhaps, as yet, too limited to express any decided opinion, but so important a feature is not likely to be lost sight of.

The problem, how to dispense with, or diminish, the necessity for hand labour within the retort-house, has occupied much attention for a great number of years, until at last, after many failures, a gleam of success seems to be rewarding the persevering efforts of those who have devoted themselves to its solution. Foulis's hydraulic stoker may be said to have taken firm root in Manchester, where it is found to effect a considerable saving in the cost of carbonizing, and it is also under consideration for adoption at the Beckton works; while West's machines, coupled with the system of light charges at short intervals, are finding favour in many quarters.

Mr. Eldridge, of Richmond, very courteously gave me the opportunity, a short time ago, of viewing those in use at his works, and what I saw pleased me very much. Speaking generally, the endeavour to render automatical the present method of charging by hand, has usually resulted in an enormous waste of power, with only partial success; but Mr. West, by separating the two operations to be performed—namely, lifting the coal and putting it into the retorts, has avoided a difficulty which has too often proved fatal, and produced a machine at once simple, unpretending, and undeniably effective in diminishing to a great degree the necessity for manual labour. We may fairly welcome the introduction of these machines as a step in the right direction, and a valuable contribution to one of the most pressing questions of the day.

The system of light charges at frequent intervals, as practised by Mr. West, can hardly be described as new, inasmuch as it prevails to a considerable extent upon the Continent, where it is said to be productive of very satisfactory results. Certain it is that light charges are found to work off more gas per ton than heavy ones; and indeed upon this point it may be said, that a more intimate knowledge of the conditions under which evolution proceeds within the retort will inevitably reveal to us the fact that carbonization, as commonly conducted, is by no means the economical process that it ought to be. We may well believe that, without the aid of any adventitious methods, such as are almost daily forced upon our attention, and which are too frequently only so many blows aimed at the simplicity of the process, a greatly increased yield of gas is possible of attainment, and to this end our efforts should be directed.

The value of residual products, notably of tar and liquor, has undergone a complete change of late years, so that what were formerly little better than drugs in the market now contribute materially to the revenues of gas undertakings. Fortunately, it is almost needless, at the present day, to direct attention to the complete extraction of ammonia as our bounden duty, for, regarded solely from a commercial point of view, the suicidal policy of negligence in this respect is sufficiently obvious; and yet only a few years ago such neglect was all but universal. It may be said, "How shortsighted must the Companies have been to allow such a state of things to continue for so long a period!" And there is much truth in such criticism, for too often this source of revenue has been overlooked. But then, on the other hand, it must be recollected that ammoniacal liquor, for a very long period, was worth very little; and also, that chemists were, at one time, by no means agreed as to the advisability of the complete removal of ammonia from the gas, it being urged, among other reasons for its retention, that its presence hindered the deposition of naphthaline. Whatever foundation there may have been for such belief, it is probably sufficient for us to know that such considerations have disappeared before the rapidly advancing value of this product, the proper place for which, it is now universally acknowledged, is not in the gas, but under the ground.

The exhaustion of the guano deposits has turned the attention of agriculturists to sulphate of ammonia as one of the chief sources whence to derive their supply of nitrogen for the soil, and the demand thus created, increased by the ever-growing necessity for higher cultivation, has been eminently favourable to its disposal. The result is consequently what we now see it, that gas liquor has maintained its position in the market throughout a period of almost unparalleled depression, affecting adversely every other product; nor is there any reason to believe that it will not continue so to do, for, in the opinion of the most competent judges, a yet greater demand may be expected for it in the future.

But not only is the gas manufacturer indebted to ammonia for a most important contribution to his revenue, it is at the same time a very valuable agent in the removal of the remaining impurities, and as such should be employed to the utmost possible extent before its final disposal. Indeed, purification by its means, in closed vessels, offers so many advantages over the ordinary methods that, as might be expected, many attempts have been made to supersede the latter, either wholly or in part, by perfecting the application of the former. If only ammonia were produced in sufficient quantity with the gas, then indeed the work of purification would be simply and inexpensively performed, and we should probably hear no more of the much vexed question of the sulphur compounds; but, as it is, we have to cast about for means whereby the quantity at our command can be employed over and over again. Hills's method, as practised by Mr. Livesey, enables this to be done to a considerable extent, and other processes are now offered having the same object in view, so that it can scarcely be a matter for speculation as to whether in the future ammonia will not come to the front as our primary purifying agent. Be it always remembered that coal gas contains within itself the materials for its own purification; it is for us to find out the proper means of employing them.

From the necessity for the removal of sulphur compounds other than sulphuretted hydrogen, gas managers in the provinces are, as a rule, exempt; for, with few exceptions, it is only the Metropolitan Companies who are subjected to pressure in this respect. The attainment, however, of a high standard of purity is really a matter which concerns us all, if we would extend, by every means in our power, the use of gas wherever applicable. There can be little doubt that the too often noxious character of the products of its combustion has hitherto retarded its employment for many purposes, and although overcome to a great extent by more perfect ventilation, it is surely, at least, as much our duty to endeavour to remove the cause, as it is to point out a remedy for the inconvenience complained of. While, therefore, sympathizing to the fullest extent with our brethren in the Metropolis in the difficult position in which the demands of the public have placed them, I think we should be wanting in appreciation of the necessities of the case did we not endeavour to meet those demands, rather than denounce them as unreasonable and exacting.

In designing gas-works, it is, of course, of the last importance that the details should be so arranged as to enable the various operations to be conducted with the greatest possible ease and consequent economy; nor will it now-a-days be admitted, as a sufficient excuse for want of efficiency, that they were originally planned to suit a condition of things no longer existing. Our position with the public depends upon our being able to supply a cheaper source of light than they can obtain elsewhere, or by other means, and we cannot afford to neglect any precaution by which such position may be strengthened; otherwise, the lightest penalty that may ensue will be diminished profits, with attendant loss of capital.

Of the attention which has of late years been bestowed upon every part of the apparatus of gas-works, tanks and holders have naturally attracted to themselves a by no means inconsiderable share. In the construction of tanks, Portland cement concrete is now extensively employed, and where suitable material for it can be obtained upon, or near to, the site of the works, its cost compares favourably with that of brickwork; but it can hardly be said to be equally reliable, and needs to be used with caution, especially where the foundations are uncertain. In the present imperfect state of our knowledge as to the proper methods of mixing and applying concrete, it would seem that its use in blocks, bedded and jointed in the same way as stone, offers the best guarantee for stability, when employed for the construction

of tank walls. Where such stability can be ensured, whether by means of brickwork or concrete, there can be little doubt but that, in Portland cement rendering, we have a cheap and efficient substitute for clay puddle.

With regard to gasholders, the chief points of interest are the wrought or cast iron stanchions which, in a few instances, have been preferred to the ordinary cast-iron columns for the outside framing, and the abandonment of the trussed roof. In point of economy little is to be gained by the adoption of the stanchion; but it possesses, in the eyes of some, the merit of being lighter in appearance, and of having its strength concentrated in the direction in which it is most required; although, on the other hand, a column properly designed is capable, with the same weight of metal, —cast for cast—of resisting the utmost strain to which it may be exposed in any direction.

The abandonment of the trussed roof, in holders of any considerable dimensions, materially reduces the cost of the structure, and, by diminishing the weight of the crown, adds to its stability; but, at the same time, a somewhat indefinite dread of the strain which, when the holder is in action, is supposed to be thus thrown upon the curb, has led to the strengthening of this latter to such an extent as to make a serious inroad into the previous saving. If, however, I, for one, entertain grave doubts as to the necessity for such precautions, it is because I am unable to conceive of any strain greater in extent than that which is due to the weight of the holder distributed; and that this is counterbalanced by the pressure within, exerted by the gas equally in all directions, is capable of easy proof. Consequently, the hope may not be vain that a problem which has engaged the attention of some of our best mathematicians without result, will find a safe and practical solution in the gradual return to that simplicity of design which in the curb was formerly deemed adequate.

Well, gentlemen, when we have constructed our works upon the most approved modern principles, when we have done our best to apply to our manufacture all the most economical and efficient methods, and delivered our gas to the consumers with a minimum of loss, is there anything remaining for us to do? Yes, say our critics, your work is by no means complete, for you are nothing if you are not versatile. You should be prepared to advocate the claims of gas in season and out of season, and, by means of lectures and exhibitions, endeavour to familiarize the public with the many and economical uses to which it may be applied. By so doing you will impart an additional stimulus to your business, the good effects of which must soon become apparent, and, at the same time, you may, perhaps, succeed in removing some portion of the unpopularity which unfortunately too often attaches to gas undertakings.

We can hardly fail to recognize the soundness of this most friendly advice, nor, if possessing the necessary qualifications, should we hesitate to act upon it. It may be, however, that, as individuals, it is not permitted us to do all that we could desire in furtherance of an object so eminently calculated to promote our best interests, but as an Association it ought to be in our power to accomplish a great deal. Let us not, then, shrink from joining those who are already at work in the wide field before us, remembering always that our first aim is to cheapen production; but if, in addition to effecting this, we succeed, as time rolls on, in becoming, by its agency, better exponents of the article we manufacture, then surely this Association will not have existed in vain.

ABERAVON CORPORATION GAS-WORKS.

Profit and Loss Account for the Year ending Aug. 31, 1877.

Coal	£283	1	10	Gas-rental	£811	15	1
Wages	252	2	8	Meter, &c.	41	18	10
Lime and carriage	8	12	0	Coke, tar, and refuse lime	74	6	10
Repairs, &c.	69	7	4½	Gas to public lamps	198	0	0
Salaries	37	2	0	Fittings	2	5	6
Rates and taxes	26	9	10	Meters sold	11	9	6
Haulage	50	18	0	Deposits received	3	0	0
Tradesmen's bills	67	2	8				
Relaying and new services	6	10	3½				
Incidental expenses, including printing and stationery	7	9	11				
Meters	18	10	3				
Law charges	35	5	6				
	£862	12	4				
Balance carried down	280	3	5				
	£1142	15	9		£1142	15	9
Interest on loans	£268	5	1	Balance brought down	£230	3	5
Banker's interest and commission	40	11	5	Balance profit, Aug. 31, 1876	49	0	11½
Costs of inquiry	4	14	0				
Deposits repaid	2	0	0				
	£315	10	6				
Balance	13	13	10½				
	£329	4	4½		£329	4	4½

Capital Account.

Loans, Aug. 31, 1876	£4825	15	11	Expenditure to Aug. 31, 1876	£5652	2	11
Do. since	1800	0	0	Expended since—			
	£6625	15	11	New purifiers and condensers	207	5	11
Less loans paid off	701	13	11	Purchase of lands	119	15	6
	£5924	2	0	New mains	332	1	7½
Balance	424	19	2½	Office furniture	5	10	6
				Meters	32	4	9
	£6349	1	2½		£6349	1	2½

WATER SUPPLY FOR NEW YORK CITY.

The last plan submitted to the Special Committee on Water Supply for New York City is by a Brooklyn engineer, who claims a cheaper mode of getting water than by going 50 or 60 miles for it. His plan is the construction of a close canal or conduit, on a low level, of sufficient width and depth, commencing at Harlem River, running through Westchester, following the lowlands, and keeping the depth below the well level. This conduit, he states, would always be full of the purest water, supplied from the great underground water-basin of Westchester, and would in its course intercept all the springs and streams. Having studied the water supply of Brooklyn, he was led to make a proposal to furnish that city with a future supply at a much cheaper rate than could be obtained by building reservoirs, and he thinks the same plan would be applicable to New York, although the soil is very different. The soil of Long Island is of such a nature that it readily absorbs all the rainfall. What streams there are come from springs fed from the higher grounds. The soil of Westchester is different from that of Long Island; it is harder and more compact, and much more of the rainfall runs off the surface; that which is absorbed remains longer in the soil. Hence a long drought would not affect the wells in Westchester as much as those on Long Island. The Brooklyn conduit, which carries the water to the pumping-wells, was built as low as possible, in order to collect the water from the different springs, yet built above the well level; and, by extending it, sufficient elevation to the mile was given to impart the necessary current to send the water to the pumping-wells; till now, in 17 miles, it has risen above the springs, and no more water can be obtained without building reservoirs, or adopting the plan he suggests. The conduit for New York was built high in order to get an elevation without pumping, and was carried back 40 miles to the high ground of the Croton, passing many streams, and getting no advantage from the many valleys in its course, or from the great watershed lying within 30 miles of New York—resources sufficient, if improved, to give an abundant supply for all time.

It is contemplated to build more reservoirs on these high elevations, at a cost of 10,000,000 dols., and to build a new conduit between New York and Croton Dam at a cost of 10,000,000 dols. more. In regard to this, he says, to keep building expensive reservoirs on these high elevations is a waste of public money, and will natrally prove a failure as to a future supply, for, as the line is extended, it must keep rising, although already it is above the springs. What water may be obtained in this way is from storm flows, collected during the time of freshets, and retained in their shallow basins, stagnant pools, exposed to the rays of the sun, and infected by vegetable decomposition, with no circulation whatever until it is let off into the conduit, thus distributing the seeds of malaria. The best place for reservoirs is where you can get the purest water, and that is at the foot of the hills. Here not only the surface flow is got, but as much more pure spring water, filtered through the upper lands. The expense of pumping will not compare with that of building costly reservoirs on such high elevations; but even if it did, the sanitary advantages would more than compensate. As the land naturally rises from Harlem River, a conduit could be built, on a slight elevation to the mile, of sufficient width and depth to bring to the city as much water as would be needed for all future time. The water in the canal would be spring water and a running stream. The pumping-engines could be placed at the Harlem River, and pump directly into the pipes, under pressure, giving the water sufficient force to carry it into the top storey of the houses on Murray Hill, leaving the old aqueduct, with its reservoirs, to supply the lower portion of the city.

In brief, the plan is to have one main conduit, commencing at a point west of King's Bridge or east of Central Bridge, on the Westchester side of the Harlem River, extending up through Westchester, with lateral branches, running right or left, as the nature of the ground may indicate; smaller ones to be built in each of the different valleys, and a cross tunnel made to intercept them all. By this means a large amount of water could be obtained, and the conduit could be extended according to the growth of the city. The main conduit, at the commencement, would not be less than 12 feet in diameter, or of sufficient capacity to deliver 200 million gallons daily; it could be diminished as extended. The side walls of the conduit would be of heavy stone laid dry, backed up with small ones, the bottom paved with cobble stone, and the top arched with brick laid in cement. The pumping-wells and buildings could be erected on the New York side of the Harlem River, the river to be tunnelled with either an iron or a brick tunnel of the same dimensions as the conduit, the top to be 12 feet below low-water mark. All the overflow would empty into Harlem River.

An approximate estimate of the cost of such works, with five compound steam pumping-engines of the most approved kind, with their boilers, fixtures, and buildings to pump 100 million gallons of water per day, is 9,500,000 dols., exclusive of the right of way, which would not cost much, as the conduit would be mostly underground. Much of the tunnelling could be done without disturbing the surface. The principal and only damage would be the surplus earth left in places. As the conduit would follow the low lands, their drainage would mitigate damages. — *Scientific American.*

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

If the Eastern Question were to assume any more definite phase, there seems to be very little doubt that an improvement of trade would at once result. In some quarters, indeed, a rather more hopeful feeling prevails now that the intentions and policy of the Ministry have been explicitly detailed, and not a few persons are inclined to the belief that there will very shortly be more business doing. At some of the large works, indeed, there is already more work in hand, although there is evidence that many of the new orders have been taken at prices which cannot, by any possibility, leave much, if any, margin of profit. This is especially the case with the rail contracts recently placed, not only here, but in other parts of the country. One very noticeable feature of the times is, nevertheless, the fact that, despite the depression about which there is so much complaining, nearly the whole of the blast furnaces in the county of Derby are at work, so that whatever the prices may be, there is evidently a demand somewhere or other, as we cannot suppose that all the ironmasters would be either willing or able thus to continue working simply for stock alone. It is also stated, but of this I cannot make any assertion from personal knowledge, that all the furnaces in Leicestershire and Notts are also in blast. In this vicinity matters are hardly so good, seeing that there are still several furnaces standing idle, and in North Lincolnshire the production is only on a limited scale.

So far as pig iron prices are concerned, there is little that is new to be reported, inasmuch as in almost every transaction special quotations are negotiated. Generally speaking, however, very little change has taken place, and the competition amongst vendors is so close that buyers, on the whole, have rather the better hand. In finished irons very little business is being done.

Coal and coke are selling fairly well, but prices are cut excessively low, owing to the enormous output which is being produced on all sides. I hear of locomotive coal being sold to Railway Companies at under 6s. per ton, and of various sales of steam coal at very little over 6s. 6d., or from that to 7s. In no case is there any difficulty in fixing deliveries and obtaining them regularly in accordance with buyers wishes.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There is still no sign of any material improvement in either the coal or iron trades of this district. In a few cases where colliery proprietors are pretty well covered with contracts for gas coal, they are endeavouring to secure a slight advance upon the better classes of round coal suitable for house-fire purposes, and in several instances 6d. per ton more money is being asked for Pemberton four-feet and some of the Wigan mines; but as there is no general pressure of orders in the market, and supplies, as a rule, are plentiful, it is only in exceptional cases where any advance can be obtained, and prices, as a rule, are the same as last week; the average quotations at the pit mouth being 10s. to 11s. per ton best Wigan Arley, 8s. to 9s. for common ditto, 8s. to 9s. for Pemberton four-feet, and 6s. 6d. to 7s. 6d. per ton for the better classes of common round coal. Other descriptions of fuel continue most difficult to move, and orders in bulk can be placed at very low figures. Common coal for forge and steam purposes is only in very limited request, and is offered at from 5s. 6d. to 6s. 6d. per ton. For good burgy, 5s. 3d. to 5s. 6d. per ton is obtained; but the

common sorts do not fetch more than from 4s. 6d. to 5s. per ton. For best slack, 3s. 6d. to 4s., and in some cases 4s. 6d. per ton is being obtained; but there is a good deal of this class of fuel being pushed in this district by Yorkshire firms, and common slack is being offered in the market at almost any price ranging from 2s. 3d. to 3s. 3d. per ton.

There are still very few orders in the market, either for foreign or coastwise shipment, and the houses that have to depend largely upon this branch of trade are quoting extremely low prices to secure business, common steam coal at the high level, Liverpool, being offered at less than 7s. per ton.

Local makers of iron find it very difficult to secure orders in consequence of the underselling which they have to encounter from producers in other districts. They are, however, able to keep the few furnaces in blast going, and are firm in maintaining late rates, which, for delivery into the Manchester district, remain at 51s. per ton for No. 3 foundry, and 50s. for No. 4 forge, less 2½ per cent. For finished iron there is very little inquiry, and works, as a rule, all through the district, are extremely short of orders. North country bars delivered here are offered at very low figures, and can be bought at from £6 3s. 6d. to £6 5s. per ton, whilst 2s. 6d. per ton more money is asked for local makes.

A reduction of 5 per cent. in the wages of finished iron workers has been effected in this district without any serious opposition on the part of the men.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

What contracting was done last week for the best qualities of gas coals was about 7s. 6d. per ton. There is no great pressure, however, in the way of pushing business, and there seems a disposition to wait until the end of the strike in the steam collieries, and see the result of an armistice, before entering fully into trade. There is a prospect that an arrangement will be come to between the Northumberland coal owners and pitmen to adopt a sliding scale. Notwithstanding the Northumberland men have been out three weeks, business at a great number of the Durham collieries is really in a very poor dull way. Some pits are standing, and others are only doing six days a fortnight. The short time, however, is mainly amongst the small second-class pits, which have a very hard struggling time of it in tolerably good times, and which can only pay a profit to the owners when business is brisk, and prices are comparatively high. All the best and medium gas collieries are working full time. But to show there is nothing extra in the trade, it may be mentioned that loading turns are, at the shipping-places, very nearly immediate, or at most two or three days. The house collieries on the Wear are bringing their work up very well; but there is a good deal of broken time. Of course, there is no business of any value astir in the Northumberland coal-fields. Masters and men are made to feel the consequences of going to war. Trade is being driven away to other districts, and it is a question whether it can be got back again. The present generation of Northumberland pitmen have experienced, and are likely to, for the first time in their lives, something very like destitution. The people are not absolutely starving, but there are a great many families who are extremely ill off.

The coasting freight market could not well be in a more depressed state than it was last week. Small sailing ships came dropping in, but they had been engaged previous to leaving their homes by the Gas Companies, and after discharging corn, flour, and other cargo, loaded up gas coals for the South. The rate of freight for steamers to London was from 4s. 1½d. to 4s. 3d., with very little inquiry. Some cargoes were shipped for the northern ports of France, and about half a dozen steamers loaded gas coals for Italian ports. Cargoes of gas coals were also shipped to Ireland. The shipments abroad were limited to gas coals.

The general manufacturing trades of the Tyne and Wear get on somehow. There is rather a large amount of iron steam tonnage building; launches of steamers are occurring every week, but the builders have not many new orders upon their books. The manufactured iron trade is doing a little better probably, but very little profit can be had out of manufactured iron at present prices. There is a great abundance of labour in all branches of trade, and wages are lower. It may be roughly estimated that, taking employment all round, wages are 2s. 6d. per week less than last year at this time. The ordinary labouring men feel the pinch of the times bitterly, and unskilled labour has had to abate its pretensions considerably lately. In fact, if there were not a good deal of work on hand in the iron shipbuilding yards, labourers would have to submit to much lower wages than they are even doing now.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

A special meeting of the Police Commissioners of Kirkintilloch was held a few days ago, for the purpose of resuming consideration, and, if so resolved, of approving of a resolution adopted by them on the 6th of September last—viz., "That the Burghs Gas Supply (Scotland) Act, 1876, be adopted in and applied to the burgh." The motion was unanimously agreed to. A movement has been since set on foot against the adoption of the Act, and a poll of the ratepayers may have to be taken on the subject.

The ratepayers of Elgin have approved of the action of the Town Council in adopting the Burghs Gas Supply Act. The matter went to the vote last Tuesday, when the following result was announced at the close of the poll:—For transference of the gas supply to the town, 176; against, 84; majority for the Council, 92.

At the ordinary monthly meeting of the Town Council of Hamilton, held on Thursday week, the state of the gas-works was under consideration. The Gas Committee, in order to meet the increasing demand for gas, which, with present storeage accommodation, they were unable to supply, recommended the construction of an additional holder, to be erected behind the present works on the feu last taken off. The Committee had submitted the matter to Mr. Barr, C.E., who reported that the present condition of the works was not very satisfactory, and in more respects than want of gasholder room they were behind the requirements of the burgh. The three holders now in use gave an effective cubic capacity equal to about 100,000 cubic feet, or two-thirds of the present requirement. He indicated where a new holder of 75 feet diameter could be erected. Such a holder, with telescopic lift, would increase the capacity 164,000 cubic feet; and a further increase could be made by telescoping the present 50-feet holder, which would further increase the capacity 30,000 cubic feet, or a total of 294,000 cubic feet. The present exhauster was notoriously insufficient, and the scrubbers, purifiers, and meter were likewise too small, and in such positions as to prevent their extension. He pointed out an arrangement of the works which would duplicate them. The probable cost of the 75-feet holder he estimated at £5000 to £6000. The Committee recommended that estimates be taken for the gasholder meantime, leaving other improvements suggested for further consideration. After a good deal of discussion, the recommendation was approved of. In regard to the price of gas, Bailie Cassels stated that the remit as to reducing the price of gas had been considered, and that the Committee had resolved that it should not be altered till the end of the financial year.

On the 11th inst., the Glasgow Corporation Gas 9 per cent. Annuities were raised £2 at 216, and on Tuesday last they were further advanced in price, the day's transactions closing at 218. The 6¾ per cent. Annuities were also advanced to 163½.

During the week ending Jan. 12, Dr. Wallace found the Glasgow gas to give the following results in respect of illuminating power:—Minimum ranging from 25·43 candles to 26·72 candles; maximum from 26·84 candles to 29·13 candles; average from 26·25 candles to 27·61 candles. The western district showed the highest results.

In accordance with a recommendation of the Greenock Corporation Gas Committee, the Police Board of that town, at their usual monthly meeting held last week, agreed to hand over to the Charitable Society 100 tons of coke free of charge, and to supply additional quantities at the rate of 2s. 6d. per ton.

At the usual fortnightly meeting of the Chemical Section of the Philosophic Society of Glasgow, held on the evening of Monday, the 14th inst.—Professor John Ferguson, M.A., President, in the chair—a paper was read by Mr. John Mayer, F.C.S., Secretary of the section, on "Hislop's Improved Process of Regenerating the Lime used in the Purification of Coal Gas." Amongst the gentlemen present there were Councillor Dron, member of the Corporation Gas Committee; Dr. Wallace, Gas Examiner for the city; Mr. James R. Napier, F.R.S.; and a number of Gas Managers, including Mr. Samuel Stewart, Greenock; Mr. James Hislop, Maryhill; Mr. G. R. Hislop, Paisley; Mr. William Key, Tradeston; Mr. James Robb, Ayr, &c. A long and interesting discussion followed the reading of the paper.

On Saturday week the Police Commissioners of Blairgowrie, along with Mr. Young, C.E., Perth, met to hear any objections that might be urged to the proposed drainage scheme. No objections being made, the Commissioners resolved to proceed. Seventeen offers for the drainage works were subsequently opened in private by the Commissioners, and it is said that the tenders ranged from under £3000 to over £5000, a Dundee offer being the lowest. No decision as to the acceptance of any offer was arrived at.

At their last meeting the Nairn Burgh Police Commissioners agreed unanimously, at the suggestion of the Board of Supervision, to take the preliminary steps for a general system of sewerage for the Burgh, and to apply to the Loan Commissioners for a loan for this purpose, as also for satisfactorily completing the water-works. A committee were appointed to select an engineer of experience.

There have been one or two slight "spurts" in the way of a rise in the price of pig iron during the past week in the Glasgow market; but the week closed on Friday with a steady market, and business done at 50s. 9d. and 50s. 10d. cash.

Nothing new has arisen in the coal trade, except, possibly, a feeling of depression caused by the failure of two firms closely connected with the foreign shipment of coals.

EXPLOSION OF GAS AT BACUP.—Last Tuesday evening, about six o'clock, an explosion of gas took place at Lee Mill, near Bacup. At the time Mr. John Rushton, slater, and his family were at tea, when they perceived a strong smell of gas, which was soon followed by a loud report, upheaving the house floor the moving of the table and dresser, and the clinking of crockery. A policeman who was passing at the time also felt the footpath lift under him, and saw a blue light on the other side of the road beside the railway line. Information was at once given at the gas office, and a staff of men were set to work to find the leakage. The gas-main at the place in question is 20 inches in diameter, and it is presumed that the main had been damaged, probably by some heavy weight passing over it, and that the liberated gas had found its way into the drains of Mr. Rushton's house, and, coming in contact either with the fire or the lights in the kitchen, ignited. Fortunately no personal injuries were sustained.

SALES OF PROVINCIAL GAS SHARES.—On the 8th inst., £400 worth of consolidated stock in the Cambridge University and Town Gas Company was sold by auction in eight lots, of £50 each. The biddings began at £90, and ended at £100, the stock thus realizing cent. per cent. On the 16th inst. 8000 shares of £5 each in the South Bank and Normanby Gaslight and Coke Company, Limited, were offered for sale by public auction at Stockton-on-Tees. The shares were offered for sale by auction in accordance with the provisions of the Company's Provisional Order of 1877, which limits the dividend to 7 per cent., subject to the sliding scale of dividend, *pro ratâ* with the price charged for gas. The conditions attached to the sale set forth, *inter alia*, that nothing had been paid or called on the shares; that the amount of premium bid on each share would be the only payment required at present from the purchaser; and that the calls hereafter to be made would not exceed 10s. per share, nor be called at less intervals than three months. The lots comprised not less than five nor more than 50 shares, and the prices realized were from 5s. to 10s. per share premium.

EXPLOSION AT THE RADFORD GAS-WORKS.—On Thursday morning last about six o'clock, an explosion occurred at the Nottingham Corporation Gas-Works, Radford, which, although of a very alarming nature, was happily unattended by loss of life. The scene of the explosion was the governor-room of the gas-works. It appears that an unusually strong back pressure in the Basford main caused the gas to escape rather too freely from the governor of this main. The consequence was that the room was soon filled with gas. About five minutes to six one of the workmen opened the door of the room, and the accumulated gas escaped, and, becoming ignited at a lamp in the passage, exploded with a terrific noise, which was heard over half a mile away, blowing the glass out of the windows of the room itself and of several houses in the immediate vicinity. The Manager (Mr. Tragg), who fortunately lives close by, hearing the noise of the explosion, hurried out, and, with great presence of mind, throwing a coat over his head, rushed into the governor-room, at great personal risk, and attempted to turn off the escape-valve of the Basford governor. Twice had he to come into the open air on account of suffocation before he accomplished this dangerous task. The Nottingham Fire Brigade were telegraphed for, but their services were not required. With the exception of one man, who got his hand slightly scorched, no personal injuries were inflicted.

PORTLAND CEMENT CONCRETE.—At the Meeting of the Liverpool Engineering Society on the 16th inst., Mr. Wilfred S. Boult read a paper on "Portland Cement Concrete." After enumerating the advantages of employing concrete in place of brickwork or stone in certain positions, he said he considered a *primâ facie* case made out in its favour, whenever there happened to be large spoil heaps of rock rubbish, or considerable deposits of shingle or gravel. For tide work he considered concrete blocks to have a decided advantage over its rivals, on account of the rapidity with which the blocks, when formed, could be set in place. From his own experience, Mr. Boult said he had known of as many as forty-five 7-ton blocks being set in one tide by one setting gang with the aid of a steam jemmy. He considered that in order to get good concrete, great care should be taken to have a proper gradation in the sizes of the stones, or materials used as aggregates. When speaking of the strength of Portland cement, he mentioned that the specification of Mr. Deacon, Borough

Engineer, required 800 lbs., and that of Mr. Lyster, the Dock Engineer, 700 lbs. per 2¼-inch testing section. The paper was well illustrated by numerous diagrams and photographs of machinery employed in mixing concrete, and in constructing concrete works, which the author described in detail. After describing the construction of a concrete graving dock, 950 feet in length, with which he had been connected, and the machinery employed, he concluded by giving many statistics of the actual cost of concrete work. From these we gather that the cost of labour in making concrete blocks in large quantities amounts to only 2s. 7d. per cubic yard.

Local Government Board Inquiries.—On the 11th inst., Mr. Arnold Taylor held an inquiry at Lichfield, in consequence of an application of the Corporation to borrow £10,000, for the purpose of enabling them to proceed with the sewerage scheme, which has been for some time on foot. Mr. Griffiths, the Engineer for the Works, laid before the Inspector an estimate of the amount which will probably be required to enable the Board to complete the work, including the outfall. This was fixed at £14,799, and the Inspector advised the Corporation to make application to the Local Government Board for sanction to borrow that amount, and this it was decided to do. The Inspector visited the outfall works, and afterwards intimated that he would make his report in the usual course.—On the 18th inst., Mr. Harrison held an inquiry at Buxton, relative to the application of the Local Board to amend the Town's Improvement Act, and to borrow further sums of money to carry on works now in progress and projected in the town. The first item considered was a further loan to complete new gas-works, which are calculated to cost £21,140, and will be capable of producing half a million feet of gas per day, whereas the works now existing only produced 90,000 feet per day. No opposition was offered, and the Inspector said the money was enough to construct works on the most approved system, and he hoped they would be able to make gas of a far better quality than they did at present.

Co-operative Sanitation.—The ingenious Scots have hit upon a plan for cheapening the luxury of sound sanitary advice. Some of the leading noblemen and gentlemen in the neighbourhood of Edinburgh have been struck with the difficulty that at present hampers the householder in obtaining skilled opinions upon, and periodical inspection of, sanitary appliances in their dwellings. For one thing, it is extremely costly to fee experts, and then there is often suspicion that the cheap sanitary engineer is in league with patent-mongers or opulent plumbers, whose influence on his opinion is the reverse of wholesome. The only way of avoiding faithless counsellors is to consult a professional engineer of high scientific standing, whose fees are usually fixed at prohibitive rates. For want of any means of getting advice of this sort, houses get into an insanitary condition before the occupiers are aware of the fact. Perhaps it is not till death has stricken his family that the householder becomes conscious of the unwholesomeness of his dwelling. To meet such cases, it is proposed by some of the most distinguished citizens of Edinburgh to apply the co-operative principle to scientific sanitary inspection. They are attempting to organize an association, the annual subscription to which will be one guinea, for the purpose of securing to its members, free of charge, that skilled sanitary supervision and advice which could only be got at enormous cost through individual action. The association is to secure the exclusive services of one or more well-educated young engineers, who, acting under the sober control of a consulting engineer of high standing, will, when required, inspect and report upon the dwellings of members, giving estimates as to the cost of any alterations that may be deemed advisable. Their recommendations must be limited to strictly indispensable points, and no officer of the association is to hold any pecuniary interest in any patent or manufacture. The Professor of Engineering in the University of Edinburgh has taken such a warm interest in this novel scheme, that he has offered for the first year to give the association his gratuitous services. Another feature of the scheme is that each member, on payment of a trifling fee, may secure the services of the officials for any charitable society whose work in individual cases might be aided by them, or for any person in whom they are interested, who, though deserving, is too poor to obtain for himself good sanitary advice. This association involves the novel application of a very old principle. It simply does for the sanitation of the houses of the middle classes what the medical club or sick society does for the personal sanitation of the artisan, who, if he were to act individually, could not afford to purchase the best medical advice. There is no reason why so sensible and beneficent an idea should not be successfully carried out in practice.—*Examiner.*

Register of New Patents.

3227.—Baldwin, T., Manchester, and Bailey, W. H., Salford, "*Improvements in pressure-gauges.*" Patent dated Aug. 16, 1876.

These improvements consist in so combining a barometer, which indicates the pressure of the atmosphere, and a pressure-gauge to indicate the difference between the pressure of the atmosphere and the pressure of steam, or the other elastic fluid, in the vessel to the said pressure-gauge is attached. Such a vessel is the condenser or the exhaust passage of a condensing steam-engine, and for the purpose of ascertaining the pressure in such condenser or exhaust passage the instrument is more particularly intended to be used. A sliding scale, having the pressure in pounds per square inch, or in inches of mercury, or both, is so placed that its zero, or line of no pressure, may at any time be moved, so as to coincide or agree with the surface of the mercury, or with the index hand of the barometer, and so enable the absolute pressure in the condenser of a steam-engine to be read off at once by merely noting the position on the sliding scale of the surface of the mercury, or the position of the index hand of the pressure-gauge, which will show at once the absolute pressure of the fluid in the condenser, whatever the pressure of the atmosphere may be at any time. The zero line may also be ascertained and marked on an indicator diagram to show the true absolute pressure thereon, and the condenser tested at any time as to its proper working condition.

This absolute vacuum gauge may be made with the index hands concentric when the barometer and pressure-gauge are constructed in a similar manner to the aneroid or Bourdon, or other spring-gauge or barometer, and the sliding scale for showing the absolute pressure may be made to slide in the required curve for that purpose.

When glass tubes are used for the barometer and for the gauge, the sliding scale is by preference placed between the two tubes, so that the absolute pressure shown by the distance between the surfaces of the mercury in the two tubes may be more easily measured, and the absolute pressure in the condenser determined.

A light disc or curved arm, or ring, may be attached to the index hand of the barometer, with a scale upon it, the zero of which will always show the pressure of the atmosphere, and thus the scale will always be in the right position without sliding, so that the index hand of the gauge attached to the condenser will point to it, and at once indicate the absolute pressure in the condenser.

The scale for pressures and the sliding scale may, when required, if an aneroid or other spring-gauge or barometer is used, be made straight instead of curved, by using any suitable gearing for the purpose, such, for example, as a light rack and pinion, or any suitable combination of link work.

3231.—Peebles, D. B., Edinburgh, "*Improvements in apparatus for governing or regulating and adjusting, or otherwise acting on the flow or pressure of illuminating gas, a part of the said improvements being also applicable to two-way or multiple-way valves for other fluids.*" Patent dated Aug. 16, 1876.

This invention comprises various improvements in details specially designed for the transmission and application of illuminating gas, but a part of the improvements is also advantageously applicable to two-way or multiple-way valves for other fluids.

In one improved arrangement a light electric current can be used for regulating or varying the action of governors at a greater or less distance; and this arrangement is especially suited for governor arrangements of the kind described in the specification of letters patent obtained by the present inventor, and dated June 26, 1875 (No. 2328), in which arrangements a large governor is controlled by means of a comparatively very small governor. A separate weight is applied to the diaphragm, disc, or bell of the small governor, apart from which separate weight the governor is adjusted to allow a certain small flow of gas to pass, either barely sufficient to keep the burners alight, or as much more as the circumstances of each case may require. The separate weight is such as to give a maximum flow or full pressure, and it is connected to a lever which is fitted with an armature in a position to be acted on by a small electro-magnet. When the electric circuit is closed, the magnet causes the lever to lower the weight upon the governor, diaphragm, disc, or bell, but the weight is suspended to the lever by a loose link, so that only the pressure of the weight acts on the governor. When the circuit is broken, the lever being counterbalanced, or acted on by a spring, lifts up the weight. The improved apparatus is applicable to other governor arrangements besides that referred to. Thus the street-lamps of a district, or the burners of a theatre, railway station, factory, or other large establishment, may be controlled by its means. It can also be used in combination with clock-work or other mechanism for giving flashing or intermittent lights from lighthouses or signal stations, the gas being economized and saved between the flashes instead of being wasted whilst hid by shutters.

A second part of the invention relates to the inlet valves by which the gas enters the governor apparatus; and in carrying it out two diametrically opposite apertures for the gas are made in the sides of a vertical inlet-pipe, the top of which is closed. The apertures are more or less closed by conical or conoidal valves formed on the ends of two tubes, which are screwed internally, and are upon screwed spindles, which spindles or tubes are adjustable in position, and are connected to the diaphragm, disc, or bell, so as to screw the valves in or out as required.

A third part of the invention consists in forming an improved gas-torch or lamplighter, by combining a small governor of the kind described in the specification of other letters patent obtained by the present inventor, and dated Sept. 16, 1871 (No. 2446), but loaded by a spring rather than a weight, with a cylindrical or other suitably shaped vessel to receive gas, compressed so as to constitute a sufficient supply. The vessel with the governor has attached to it a tube of sufficient length, with a burner at its upper end, the flame being shielded in the usual way if required.

A fourth part of the invention relates to an improved burner for a single gas-jet, in which a tip of steatite or other similar substance is fixed in the outer end of a shell of brass or other suitable metal, the shell being turned in and milled over the shoulder of the tip, or into a groove or grooves formed in the tip. The milling makes the burner more ornamental, and facilitates the proper fixing of it in the socket or branch-pipe end. The inner end of the shell is closed by a small block of soft metal, through which a small hole is drilled, thus making in a simpler and better manner than heretofore a class of burner which is, to a certain extent, self-regulating.

A fifth part of the invention relates to burners of the kind known as Bunsen burners, and comprises simple arrangements whereby the supplies of gas and air are simultaneously reduced or increased by one movement. In one modification a conical socket is formed in the base of the burner, and the gas inlet leads to the side of this cavity. A conical plug fitting the cavity is formed on or fixed to the main burner tube, and a way through one side and up the centre of this plug admits the gas from the inlet when the plug is in the proper position. A shell encircles the lower part of the burner-tube, and air-holes are made through it and through the tube. The shell is ordinarily a fixture, but is adjustable, and when the burner-tube is turned it closes or opens both the gas and air inlets. In another of the modifications an externally screwed nipple projects up in the centre of the base, the gas issuing up from a central aperture in the nipple. The aperture is controlled by a conical valve formed on or attached to a piece which is fixed to the burner tube, and screws upon the nipple, so that by turning the tube the gas aperture is more or less closed, the same movement acting on the air inlets as in the first modification. In a third modification the outer shell of the burner is extended to the top of the inner tube, and is closed over it. The tops or upper parts of the tube and shell are formed with holes for the issue of the mixed air and gas, and the turning of the tube (which may be done by means of a lever projecting through a slot in the shell), alters the outlet area as well as the inlets for gas and air. In all the modifications a series of the burners may be arranged so as by levers, connected all to a single rod or otherwise, to be simultaneously adjusted.

A sixth part of the invention relates to a two-way or multiple-way valve or cock suitable for any fluid, but specially designed to admit of the extreme tightness of fitting desirable in the case of illuminating gas, particularly with large valves, without attendant inconveniences. In carrying out this improvement a conical plug is employed, but instead of this plug being held in its conical casing or socket in the ordinary way, it is held by a spindle passing completely through the axis of the plug, and formed with two screw-threads of different pitches, one on the bottom end screwing into the bottom of the socket, and the other screwing into the plug. The spindle can be turned by a separate handle or key from that for turning the plug, and serves, by the powerful differential action of the two screws, for tightening the plug in its socket when adjusted, or for slightly loosening it when it requires to be adjusted.

3319.—Duckett, J. P., Rotherham, "*An improved cistern and self-acting water-waste preventer.*" Patent dated Aug. 24, 1876.

This invention has for its object the so regulating the supply of water to baths, water-closets, and such like purposes as to prevent or materially reduce the waste of water, and consists of a cistern of a peculiar shape, supported or suspended on standards or a frame by pivots, on which it is free to rock or oscillate, and the shape of the cistern is such that when full the greater weight of water at the larger end of the cistern presses down that end. At the larger end of the cistern is placed the supply-pipe fitted with a tap, and when the cistern is full of water a projection or angular piece fitted to the larger end of the cistern presses on the top of the supply-pipe so as to close it. In the bottom of the cistern is fitted the outlet-valve, which, when water is wanted to flow from the cistern, is lifted off its seating by means of a lever, which is so arranged that when it is

acting to keep open the outlet valve it is also acting on the larger end of the cistern, so as to keep the projection or angular piece pressing on the tap on the supply-pipe, but as soon as enough water has been drawn from the cistern, and the outlet-valve is allowed to close, the action of the lever upon the larger end of the cistern, and consequently on the projection or angular piece, is removed, and the cistern is allowed to oscillate on the pivots, so as to open the tap on the supply-pipe, whereby the water from the supply-pipe is allowed to flow into the cistern until the cistern is again sufficiently filled, when the larger end of the cistern is pressed down by the weight of water at that end, and causes the projection or angular piece to press upon and close the tap of the supply-pipe.

3365.—Frost, J., Huddersfield, "*Improvements in purifying sewage and foul water, and in treating water for boiler purposes.*" Patent dated Aug. 26, 1876.

In carrying out this invention it is proposed to employ the following ingredients—viz., the sulphide and hydrates of barium; hydrates of iron; and the precipitated hydrates, sulphydrates, and sulphides of the same metal; the sulphides of soda, slaked lime, carbonate of lime, and sulphuric acid. These may be employed either separately or in a variety of combinations, according to the character of the sewage or water under treatment.

3370.—Redfern, G. F., South Street, Finsbury, "*Improvements in gas motor engines, and in apparatus connected therewith.*" Patent dated Aug. 28, 1876.

The principal improvements consist in the construction of a stationary engine as follows:—

A cylinder of suitable construction is provided with a differential piston. The explosion chamber is placed at the side of the cylinder, and is provided with a slide-valve for admitting, at each revolution of the driving-shaft, the required quantity of the explosive mixture, which being inflamed enters the cylinder below the piston, acting on the smaller surface thereof; and before the piston arrives at its highest point a valve-cock allows the mixture to enter above the piston and act on its larger surface. When the piston has completed its stroke, the valve-cock, operated by a link motion, allows the escape of the gases. The cylinder and explosion chamber are surrounded by water, and an arrangement is provided for lubricating the piston with distilled water, as also the stuffing-box. The piston-rod is connected to the crank in the usual manner, and the driving shafts are made hollow, so that they may serve as reservoirs for oil. The valve-cock is operated from a grooved disc on the crank-shaft moving a lever enclosed within a casing to keep it from the water, but the water circulates through the hollow valve-cock. The slide-valve is operated by a tapped disc having a steel tappet, on which slides a pulley on the forked end of a rod, a spiral spring serving to bring the slide back to its normal position after it has been raised. On the top of the slide-valve is a pipe coming from the compresser, and provided with a suitable valve, and a governor for regulating the action of the throttle-valve. The compressor is in direct communication with the air-pump, which is double acting, and is operated by gearing. The pump sucks in air and gas, and thoroughly mixes and forces them in a condensed state into the compressor.

The gas for working the improved machine is produced as follows:—The hot air from the cylinder is caused to pass into a casing, enclosing the gas generator, consisting of a metal chamber having a square rod carrying a number of plates, on to which gasoline, petroleum, kerosine, or other heavy oil is conducted by a copper pipe. The raising of the plates causes the oil to flow downwards, and the heated gases surrounding the whole convert the oil into gas, which collects in the upper part of the chamber, and is conveyed by means of a pipe to the air-pump; the tar formed being collected in a suitable box. Pipes are provided for assisting to cool the water surrounding the working cylinder. For engines of 20-horse power and upwards the gas is produced in a separate apparatus.

The mixture of air and gas is ignited by a galvanic battery and inductor, the spark being produced by a pin on the crank-shaft, which comes into contact with a lever so as to close the circuit at the moment required.

3371.—Beb, O., Paris, "*An improved automatical apparatus for shutting cocks of gas, steam, water, or other fluids or liquids.*" Provisional protection only obtained. Dated Aug. 28, 1876.

This invention relates to apparatus for automatically shutting cocks at a determined time, such as the cocks of gas-pipes, steam, or water pipes. For this purpose there is mounted, beside the cock to be operated on, an axis, having an arm connected to, or arranged to bear against, the lever handle of the cock, and also on the opposite side of the axis an arm loaded with a weight, which, so long as it is not counterpoised, keeps the cock open. A receptacle for sand is provided, and mounted on arms projecting from the axis, which receptacle is gradually filled from a similar receptacle above, provided with a regulating sluice. When sufficient sand has run into the lower receptacle to overbalance the weight, the axis is caused to turn partly round, and its arm acting on the cock-handle, causes the cock to be closed. In order to regulate the time during which the cock has to remain open, the weight rests upon an adjusting screw, or is slid along the arm and set farther from, or nearer to, the axis, so that it will require more or less sand to flow into the lower receptacle in order to overbalance it.

3376.—Sieh, P., and Schwarz, T., Hamburg, "*Improvements in gas regulating and saving apparatus.*" Patent dated Aug. 28, 1876.

This apparatus consists of a metal case, preferably of a spherical form. In about the middle of this case an air-tight partition made of flexible material (either prepared leather or other suitable substance) divides the case into two compartments. At the lower end of the spherical case a metal tube is connected to it at right angles. This tube is likewise divided into two compartments by a horizontal partition made of sheet metal, of which the lower one is connected to the inlet-pipe of the gas. The gas passes from this compartment through a valve into the under partition of the spherical case, from which it escapes through an opening into the upper division of the metal tube leading to the gas-pipes and burners. The pressure of the gas in the spherical case is regulated by the lifting or lowering of the flexible partition, and as this partition is in connection with the gas admission valve, the opening of it is either diminished or enlarged when the pressure either rises above or falls below its normal state. From the top of the spherical case the resistance of the flexible partition can be regulated by means of weights, which can be placed on the upper surface of the same. In this manner the pressure of the gas is regulated within the spherical case, and in consequence a uniform flow of gas through the outlet-pipe is attained, and considerable saving of gas at the burners effected.

3410.—Chatwin, J., Birmingham, "*Certain improvements in the manufacture of gas-burners, as also the parts for receiving and sustaining shades for the same.*" Provisional protection only obtained. Dated Aug. 30, 1876.

From the chimney gallery of an ordinary Argand burner is supported a vertical, square, or other irregular shaped wire, covered with thin round brass tubing, this gallery having projections for supporting a small annular glass reflector. On the top of the square or other shaped wire, and resting on its tubular casing, a ring is applied centrally over the burner below, a vertical socket being secured to the ring for that purpose. The ring is provided not only with vertical wires for steadying the chimney, but also lateral projections for supporting an opal or other suitable reflector above the light.

3422.—M'Manus, H., New York, "*Improvements in gas-governers.*" Provisional protection only obtained. Dated Aug. 30. 1876.

This invention relates, first, to that class of gas-governors in which the movement of a flexible diaphragm is caused to regulate the size of the opening through which the gas flows, and it consists in constructing the different parts of the governor in such a manner as to ensure greater sensitiveness and accuracy, to facilitate adjustment to suit different pressures, to render the apparatus more durable, and to adapt it for attachment to inlet-pipes and outlet-pipes occupying different positions. A further object of this part of the invention is to facilitate the manufacture of the governor, and to prevent the apparatus from being tampered with. In carrying out this part of the invention the outer casing is constructed in two sections, an upper and a lower, the latter of which is made of a tubular form at the lower part, where it is provided with three threaded ways or branches, arranged two horizontally and the third at right angles to the other two, and this lower section is also expanded in diameter at the top to form with the upper section a shallow chamber divided horizontally by a flexible diaphragm, the edge of which is clamped between flanges formed on the two sections.

The invention relates, secondly, to apparatus applicable more particularly to gas-burners, and is for the purpose of regulating the passage of the gas. In carrying out this part of the invention, a chamber is provided between the regulating cock and the burner, the bottom of which chamber is by preference made slightly concave or dish-shaped, and has formed through it a small orifice for the passage of the gas to the burner. In this chamber there is placed a loosely-fitting thin disc of mica, gelatine, isinglass, porcelain, flexible glass, or other suitable flexible incorrodible material, which covers the gas passage, and rests at its periphery only upon the bottom of the chamber, webs or projections being provided in the upper part of the chamber, in order to maintain the disc in its proper position.

3443.—Morgan-Brown, W., Southampton Buildings, London, "*A new or an improved hydro-piro-pneumatic pump.*" Patent dated Sept. 1, 1876.

The object of this invention is to produce a new description of pump for raising water or other liquids economically and rapidly, both as regards the cost of the apparatus and its industrial results, whilst at the same time it is easily driven or manipulated. Its action is dependent essentially on the consumption of gas mixed in such proportions with air as to produce an explosive mixture as an economical and certain means of producing a vacuum in an appropriate vessel, and on the utilization of such vacuum to raise water to different heights, and in subsequently discharging it for different industrial purposes.

The patentee claims "The utilization of the explosion and expansion of hydrogen gas, whether applicable for lighting purposes or not, proportionally and homogeneously mixed in a closed vessel with atmospheric air (as well as any other gas or explosive mixture) to produce a vacuum in the vessel itself, and the utilization of the consequent instantaneous action to the raising of water or other liquids to definite levels, according to circumstances and the requirements of those who apply the system, in order to consequently discharge this raised water in canals or on soil to be irrigated, or for otherwise making use of its fall as a motive power, acting, therefore, as the case may be, sometimes as a simple suction-pump, and at the same time as a motive power, and at other times merely as a motive power, but always automatically, without opposing resistance to the free expansion of the gases in their explosion, and producing very considerable power with a comparatively very small expenditure or expense, either as regards first cost of this machinery or that of its working, for the purposes and in the manner above described."

APPLICATIONS FOR LETTERS PATENT.

161.—Jordan, C., Newport, Monmouth, "Improvements in joints for connecting pipes or tubes for gas, water, or other purposes." Jan. 12, 1878.

172.—Alexander, J., Lanark, N.B., "Improvements in engines for compressing air or gas." Jan. 14, 1878.

173.—Hunt, B., Lincoln's Inn, London, "Improvements in the process of and apparatus for superheating steam, and making, heating, and illuminating gas." A communication. (Complete specification.) Jan. 14, 1878.

188.—Meldrum, R., Edinburgh, "Improvements in drawing off liquids, and preventing the reflux of same or of gases through pipes, and in the construction of automatic traps or valves and fittings connected therewith." Jan. 15, 1878.

195.—Atkins, F. H., Fleet Street, London, "Improvements in preparing materials for filtering water and other fluids." Jan. 15, 1878.

202.—Okes, J. C. R., Marylebone, and Robinson, H., Westminster, "Improvements in filter presses." Jan. 16, 1878.

216.—Wright, F., Westminster, "An improved governor for gas-burners." Jan. 17, 1878.

219.—Graddon, J., Clapham, London, "Improvements in machinery for pumping or forcing fluids for motive power or other purposes." Jan. 17, 1878.

228.—Ramsbottom, J., Leeds, Yorks, "Improvements in engines for obtaining motive power from liquid and gaseous fluids, and for pumping and compressing." Jan. 17, 1878.

230.—Wallace, R. W., Mark Lane, and Christopher, G., Clapham, London, "Improvements in the purification of gas, and the production of bye-products therefrom." Jan. 17, 1878.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

2749.—Simon, L., Nottingham, "Improvements connected with atmospheric gas-engines." July 18, 1877.

2757.—Craig, W., New Cross, London, "Improvements in direct-acting steam-pumps." July 19, 1877.

2843.—Lake, W. R., Southampton Buildings, London, "Improvements in water-meters." A communication. July 25, 1877.

4077.—Foulis, W., Glasgow, "An improved 'dip-pipe' for gas-works." Nov. 2, 1877.

4297.—Tylor, J. J. and W. A., Newgate Street, London, "Improvements in apparatus and arrangements for regulating, controlling, and arresting the flow of liquids and fluids." Nov. 16, 1877.

PATENTS WHICH HAVE BECOME VOID.

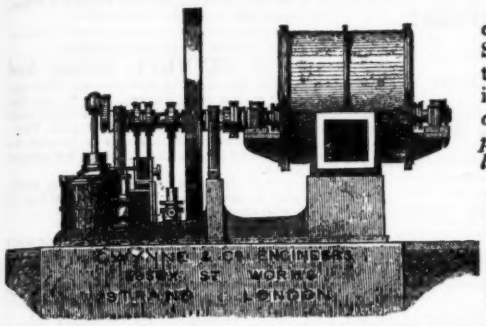
BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

66.—Kidd, J., "Improvements in the manufacture of gas for lighting and heating purposes, and in the apparatus connected therewith." Partly a communication. Jan. 7, 1875.

101.—Fyfe, D. A., and Bowers, W. H., "Improvements in the method of and apparatus for producing gas or gases for heating and for illuminating purposes." Jan. 12, 1875.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, and TWO MEDALS at the PHILADELPHIA EXHIBITION have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS;
Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

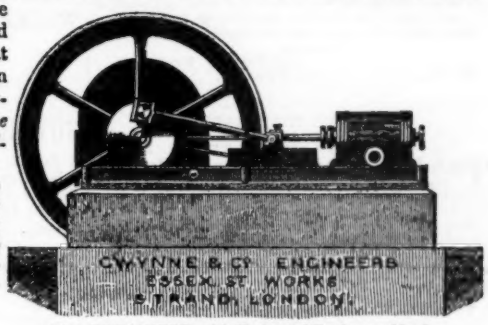
GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"*Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship.*"

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 7,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



£2,500 EXHAUSTER, with Horizontal Engine combined.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas without oscillation or variation in pressure. Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, GWYNNE & CO., Hydraulic and Gas Engineers,
ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

☞ *G. & Co. are now making 6 Sets Exhausters and Engines for 105,000 cubic feet per hour, 3 Sets 180,000 Exhausters and Engines, with many others of all Sizes.*

TO GAS ENGINEERS.

D. BRUCE PEEBLES & CO.

Beg to call the attention of Gas Engineers to the fact that the novel and original feature in connection with PEEBLES' SYSTEM OF CONTROLLING THE ACTION OF GAS GOVERNORS is the loading or acting on the Bell by Pneumatic Pressure instead of Weights.

TAY WORKS, BONNINGTON, EDINBURGH.

WANTED, Readers of the Pamphlet, "Cooking and Heating by Gas," &c.
Copies, by post, Threepence, direct from the Author, MAGNUS OHREN, Gas-Works, SYDENHAM, S.E.

WANTED, a Meter Index-taker, a Fitter preferred.
Apply, in own handwriting, stating age, wages required, and when and where last employed, to the SECRETARY, Gas Company, BATH.

WANTED, by a good Gas-Fitter, a situation as FITTER, or FITTER and METER INSPECTOR. Thoroughly competent and good testimonials.
Address FITTER, 8, George Street, Bloomsbury, LONDON.

WANTED, Orders for Samples to test the superior Silkstone, Wigan, and other Gas Coals and Cannel on Sale by G. J. EVESON, Gas Coal and Cannel Contractor, BIRMINGHAM.
N.B.—Prices on personal application, or by post or telegram, on shortest notice, and prompt delivery.

WANTED immediately, a competent GAS-FITTER, in Compo and Iron Pipe. Wages 30s. per week. A permanent situation to a respectable man. None need apply but those whose character will bear the strictest investigation.
Apply, with references, to J. DAVIES, Gas-Works, KIDSGROVE.

WOODBRIDGE GAS-WORKS, SUFFOLK.

WANTED, a Working Foreman, thoroughly competent in the manufacture and distribution of Gas, main and service laying, taking the registration of consumers meters, and fitting the same. House, &c., on the premises.
Apply, stating age and wages required, or for further particulars, to BENJAMIN D. GALL, Gas Office.

WANTED, by Samuel Thompson & Co., Colliery Office, Lancaster, APPLICATION for PRICES from Gas Managers who are prepared to receive Tenders for GAS COAL or CANNEL.
John Leigh, Esq., M.R.C.S., F.C.S., &c., &c., in his analytical report of S. T. & Co.'s Coal, says: "It is remarkable for its purity, I have scarcely ever examined a Coal containing so small a quantity of ash, and when Cannel of the best description is scarce, it may well replace this material."

A Young Man, who has had several years experience in a Gas-Works, desires a SITUATION. Is well acquainted with the manufacture and distribution of gas, and has a thorough knowledge of chemistry. Excellent testimonials.
Address No. 431, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—A Telescopic Gasholder, 25 ft. by 10 ft. 6 in., in Brick Tank. Inner Lift new two years since, with new Guide Columns, Wheels and Carriages, Chains, and Balance-weights. Must be removed for the enlargement of Works. To be sold a bargain.
For particulars and order to view, apply to R. HOLMES, Esq., Secretary, Gas Company, Arundel, SUSSEX.

SUPERINTENDENT OF GAS-WORKS.

THE Directors of the Gravesend and Milton Gaslight Company are about to appoint a SUPERINTENDENT of their Works at Gravesend. He will be required to have a thorough practical knowledge of Gas Machinery and Works, and the manufacture of Gas, and also to have had experience in the actual working of Gas-Works.
Particulars of the duties of the office can be seen at my Office, 27, King Street, Gravesend, or can be had upon application, enclosing stamped addressed envelope for return.
The salary will be £200 per annum, with house at the Works, coals, and gas.
Letters from candidates, enclosing testimonials as to character, ability, and previous service (which testimonials will be returned on application and enclosure of stamps), must reach me on or before Wednesday, the 30th of January next, after which date an appointment will be made with those candidates whose attendance may be required before the Directors.
TUFNELL SOUTHGATE, Secretary.
Gravesend, Jan. 10, 1878.

ON SALE—One Station-Meter, to pass 1000 cubic feet per hour. Almost new. Will be sold cheap.
Apply to J. HALL, Gas-Works, St. Helen's, LANCS.

FOR SALE, One Gasholder, 33 ft. by 14 ft., with cast-iron tank, columns, girders, inlet and outlet pipes, and valves.
Apply to Mr. JOHN BUDDEN, Gas-Works, Poole, DORSET.

SECOND-HAND SCRUBBER WANTED.

THE Directors of the Lurgan Gaslight Company wish to PURCHASE a good Second-hand SCRUBBER for their Works. The quantity of Coals used is about 1200 tons per year.
Parties wishing to offer will please state the dimensions, how long in use, name of maker, and price.
By order,
WILLIAM BAIRD, Secretary.
Lurgan, Jan. 7, 1878.

BOROUGH OF NEATH.

THE Gas Committee of the Town Council hereby invite TENDERS for the purchase of the whole of the surplus TAR and SULPHATE of AMMONIA to be produced and manufactured at their Works, situate at the Millands, adjacent to the Great Western Railway, Neath, for a period of One, Two, or Three years from the 1st of March, 1878.
Sealed tenders, quoting prices for delivery into buyers trucks, at the Gas-Works, to be sent to Town Clerk's Office, Neath, not later than the 27th of February next.
Further particulars (if required) may be obtained on application to the Manager, at the Works.
By order,
ALFRED CURTIS, Clerk to the Committee.
Neath, Jan. 19, 1878.

REMOVAL.

CHARLES HEISCH, F.C.S., Analytical and Consulting Chemist, Superintending Gas Examiner to the Corporation of London, &c., &c., has REMOVED from 8, Savage Gardens, to 79, MARK LANE, where he may be consulted as usual.

PINTSCH'S PATENT LIGHTING COMPANY, LIMITED.
Incorporated under the Companies Acts, 1862, 1867, and 1877.

CAPITAL £250,000, in 50,000 shares of £5 each. FIRST ISSUE of £125,000, in 25,000 shares of £5 each. Deposit on application, 10s. per share; payment on allotment, 30s. per share. If no allotment be made the deposit will be returned in full. It is provided by the Articles of Association that the Company shall not commence business until shares to the amount of not less than £50,000 (exclusive of Vendors Shares) shall have been bonâ fide subscribed for and allotted. Further calls as required at not less than three months interval.

DIRECTORS.
CHARLES F. ADAMS, Esq., 57, Coleman Street, E.C., and Barkway, near Royston, Herts, Chairman.
Lieut.-General H. J. Barr, H.M. Bombay Staff Corps, Apsleytoun, East Grinstead, Vice-Chairman.
Hon. Norman Grosvenor, 35, Park Street, Grosvenor Square, W.
Robert Melburn, Esq., Stanmore Lodge, Lower Tulse Hill, S.W.
J. Pellatt Rickman, Esq. (Pellatt and Co.), Falcon Glass Works, St. Bride Street, E.C., and Weybridge, Surrey.
W. B. Rickman, Esq., 4, Essex Court, Temple, and Richmond.
CONSULTING ENGINEER AND HONORARY DIRECTOR.—Richard Pintsch, Esq., Berlin.
BANKERS.—Messrs. Willis, Percival, and Co., 76, Lombard Street, E.C.
SOLICITORS.—Messrs. Markby, Tarry, and Stewart, 57, Coleman Street, E.C.
AUDITORS.—Messrs. Leslie, Straith, and Co., 1, Frederick's Place, Old Jewry, E.C.
GENERAL MANAGER.—Hugo Pischon, Esq.
SECRETARY.—Herbert E. M. Browne, Esq.

OFFICES: 7 AND 8, METROPOLITAN CHAMBERS, NEW BROAD STREET, E.C.

ABRIDGED PROSPECTUS.

This Company is established for the purchase of the British and Indian Patents connected with the System of Lighting Railway Carriages, &c., with oil gas, invented by the well-known Gas Engineer, Mr. Julius Pintsch, of Berlin, and introduced by him with unprecedented success on the German State and other Railways; also for acquiring the goodwill of the English business hitherto carried on at Victoria Chambers, Westminster, by the firm of Messrs. Pintsch, Pischon, and Co., together with their plant and valuable contract on hand.

Mr. Pintsch's System provides railway travellers with a safe and brilliant Light at a price so moderate that its general adoption by Railway Companies may be considered as certain. The cost per light per hour of oil gas is less than an eighth of a penny, whereas an ordinary oil lamp costs three farthings for an hour's burning. As the carriages only require filling once in 36 hours, the saving of labour is enormous.

Pintsch's Method of Lighting has been in use on the St. John's Wood line of the Metropolitan Railway for two years, and during that time no failure of any kind has occurred; not one lamp glass has been broken, and not one shilling required for repairs.

The Great Eastern Railway are now engaged in introducing Mr. Pintsch's System to a large extent.

After a lamp competition the Inventor received the Gold Medal of the Society of Arts.

Detailed Prospectuses and Forms of Application for Shares may be obtained from the Bankers, Solicitors, and Auditors; or at the Offices of the Company.

BOROUGH OF BARROW-IN-FURNESS.

THE Corporation are prepared to receive TENDERS for a GASHOLDER of 125 ft. diameter, and the ironwork connected therewith.

The plans and specification may be seen, and all necessary information obtained, of the Manager, at the Gas and Water-Works, on and after the 22nd inst.

Sealed Tenders, addressed "The Chairman of the Gas and Water Committee," and endorsed, to be delivered at the Municipal Offices not later than Jan. 29, 1878.

The lowest or any tender not necessarily accepted.

By order,
C. F. PRESTON, Town Clerk.

Municipal Offices, Barrow-in-Furness,
Jan. 11, 1878.

ROCHDALE CORPORATION.

TO FIRE-BRICK AND RETORT MAKERS.

THE Gas Committee invite Tenders for the supply of the whole of the RETORTS and FIRE-BRICKS, in quantities as required by them during the year 1878.

Forms of tender and all information may be had on application to Mr. T. O. Paterson, Gas-Works.

Tenders, endorsed "Tender for Retorts, &c.," must be sent to my Office on or before the 29th of January, 1878.

By order,
ZACH. MELLOR, Town Clerk.

Town Hall, Rochdale, Jan. 18, 1878.

CORPORATION OF NOTTINGHAM.

TO BUILDERS.

THE Gas Committee of the Corporation of Nottingham are prepared to receive TENDERS from competent Builders for the building and constructing of a BRICK TANK for Ammoniacal Water at the Basford Gas-Works.

Plans and specification may be seen at the Engineer's Office, George Street, where also forms of tender may be obtained.

Sealed and endorsed tenders to be delivered to the Town Clerk, on or before Wednesday, the 30th inst.

The Committee do not bind themselves to accept the lowest or any tender.

By order,
M. OGLE TARBOTTON, Engineer.

Gas Office, George Street,
Nottingham, Jan. 19, 1878.

THE IMPERIAL CONTINENTAL GAS ASSOCIATION BILL.

NOTICE is hereby given that an EXTRAORDINARY MEETING of the PROPRIETORS of the Imperial Continental Gas Association will be held at the City Terminus Hotel, Cannon Street, in the City of London, on THURSDAY, the 31st day of January inst., at Two o'clock in the afternoon, for the purpose of considering the provisions of the Bill now before Parliament, intituled "A Bill for Granting further Powers to the Imperial Continental Gas Association."

At such Meeting the said Bill will be submitted for the consideration and approval of the Proprietors.

ALBERT F. JACKSON,
Secretary of the Association.

Dated this 7th day of January, 1878.

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THE

GAS COMPANIES EXPENDITURE JOURNAL,

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Published by EDWARD SANDELL, Accountant, 2, Great George Street, WESTMINSTER, and W. B. KING, Office of the JOURNAL OF GAS LIGHTING, 11, Bolt Court, FLEET STREET, E.C.

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NOTICE.

THE GAS & WATER COMPANIES DIRECTORY,

1878.

(WATER SECTION.)

The Editor will feel greatly obliged if Secretaries and Engineers would fill up, and return to him at once, the forms sent them, as the work is now going to press. If any have not received Forms, they will be forwarded immediately, on application to the Editor,

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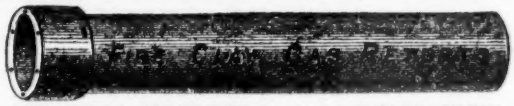

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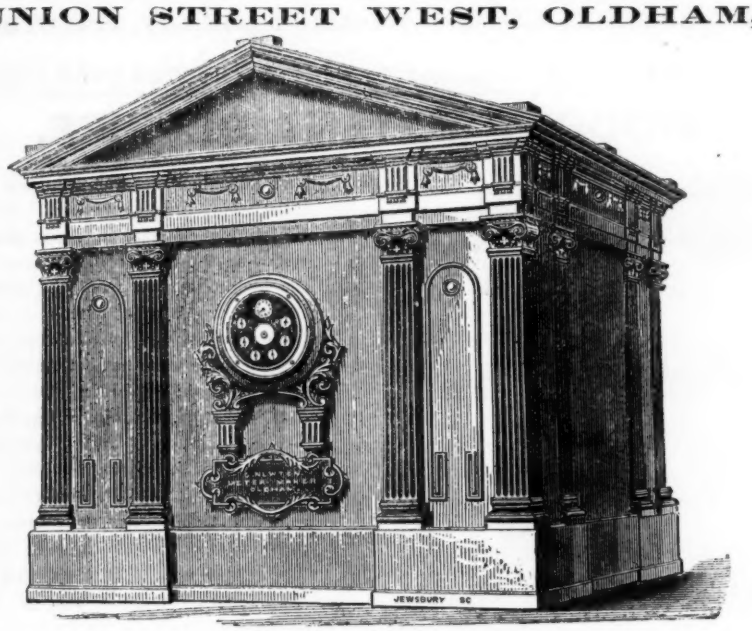

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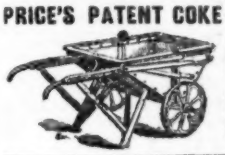

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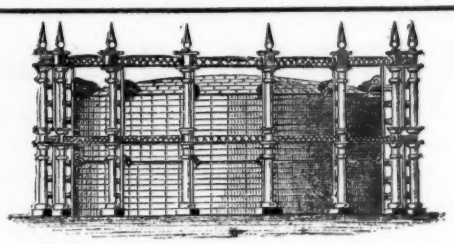

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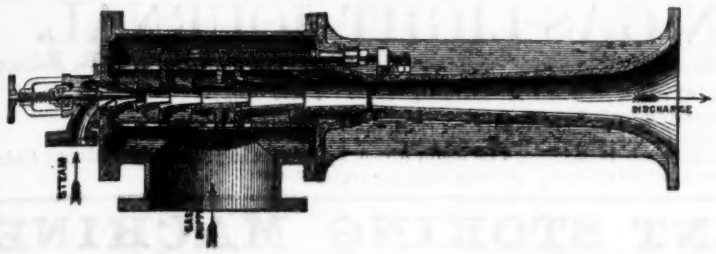

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[KIRKHAM, HULETT, AND CHANDLER'S PATENT.]

Some of the advantages claimed for this Apparatus are as follow:—

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Unerring Regularity in the Distribution of the Liquor.
Saving of Expense in Providing and Exchanging Scrubbing Material—none being required.
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Economy of First Cost and of Maintenance.
It works without Pressure.
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This Washer is intended to work in conjunction with a scrubber. It occupies a small space, and is inexpensive.

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A. M. CALLENDER & CO., Proprietors. G. WARREN DRESSER, Editor.

Issued Semi-Monthly at No. 42 Pine Street, New York City.

This Journal is especially devoted to Gas Engineering and Manufacture, and is the official organ of the AMERICAN GAS-LIGHT ASSOCIATION, and the NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

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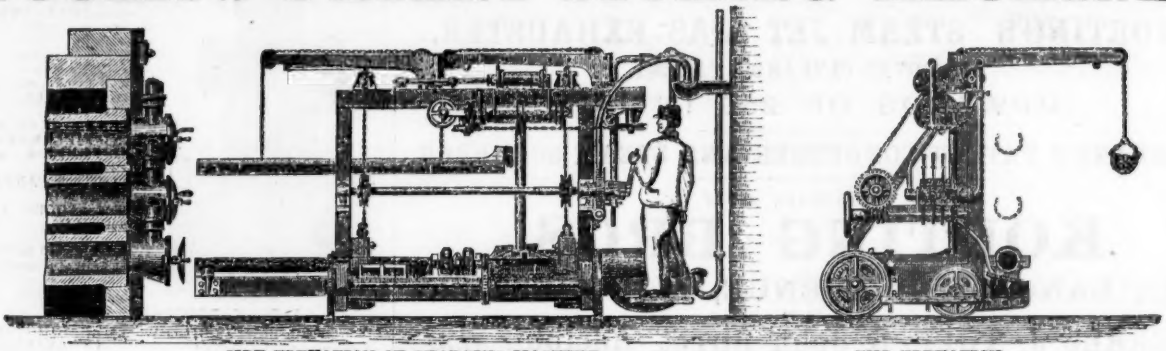

SIDE ELEVATION OF CHARGING MACHINE. END ELEVATION

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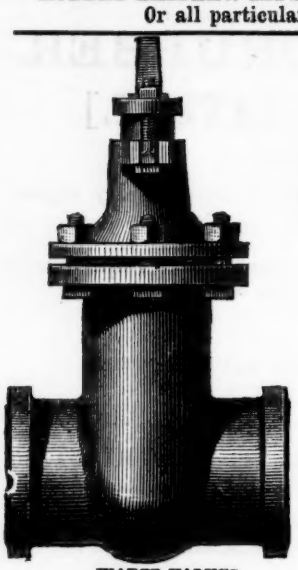

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All Sizes, Flange and Socket, kept in Stock, tested to 1000 feethead.

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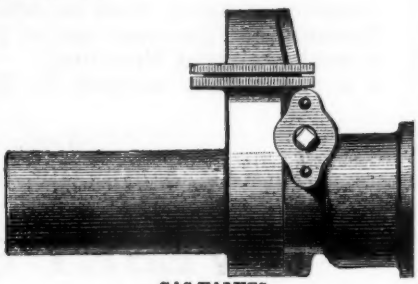
SCREW-COCKS, HYDRANTS,

SLUICES, PENSTOCKS,

And all other Machinery for

WORKS OF WATER SUPPLY, DRAINAGE AND IRRIGATION.



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MANUFACTURED BY

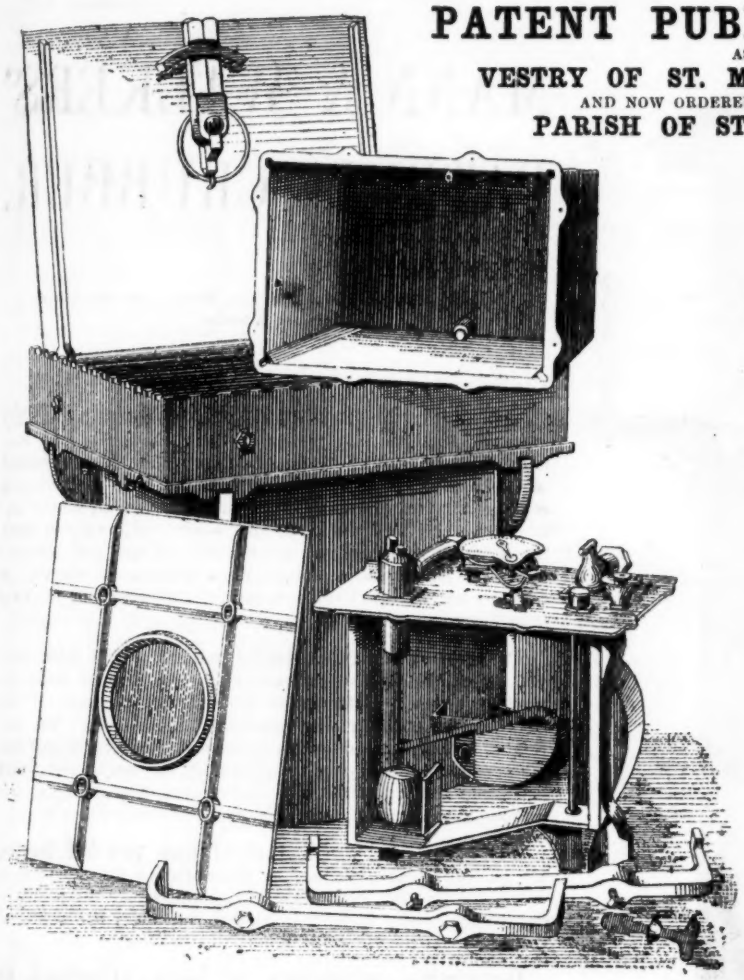
JOHN BENT & SON,

WET AND DRY GAS-METER AND GAS APPARATUS MANUFACTURERS,

BELL BARN ROAD, BIRMINGHAM.

Established 1830.

AVERAGE METER SYSTEM.



PATENT PUBLIC LAMP METERS,

AS ADOPTED BY THE

VESTRY OF ST. MARY ABBOTTS, KENSINGTON,

AND NOW ORDERED TO BE PUT IN OPERATION IN THE

PARISH OF ST. LEONARD'S, SHOREDITCH.

SUGG'S IMPROVED
LIGHTING TORCH.

SMALL SIZE
LAMP GOVERNOR,
For the inside of Lantern, with double Regulation.

WILLIAM SUGG'S
IMPROVED PATENT LAMP METER,

With adjustable Lid to suit the Slope of any Pavement.

Can be easily cleaned and repaired by any ordinary workman. Improved index and patent flexible joints. The inlet service and the connexion to stand-pipe can be cleaned out without opening the ground; the lid covers both of these. Clear glass plate on internal lid.

SUGG'S IMPROVED
LAMP COLUMN & LANTERN,

AND THE METHOD OF FIXING THE AVERAGE METER.

Note.—This kind of Meter was originally invented by William Sugg, in conjunction with Mr. Thomas Hawksley, Past-President of the Institution of Civil Engineers. They were first used at Nottingham in 1866, and are still at work. The Gaslight Company and the Corporation were both quite satisfied with the results. They were also introduced at Folkestone in 1869 by the late Mr. T. G. Barlow, Editor of the Journal of Gas Lighting. The success of the system put an end to a very long and troublesome dispute between the Gas Company and the Local Authorities. They are still at work with the same satisfactory results. They have since been used in several important towns, with equally good results.

No other kind of Lamp Meter has ever achieved so complete a success.

WILLIAM SUGG'S
PATENT PUBLIC LAMP GOVERNOR,

With Steatite Incorrodible Burners.

Guaranteed to give the greatest amount of light for the quantity of gas consumed. Nearly a Million of these, and those of William Sugg's later inventions, are in use in various parts of the globe.

MODERN STREET LIGHTING.

By WILLIAM SUGG, A.I.C.E.

Price 1s. 6d.

LIGHTING TABLE.

Diagram showing the Curves of Sunset and Sunrise throughout the Year.

Price 2s. 6d., Litho.

WILLIAM SUGG,

GAS ENGINEER,

VINCENT WORKS, VINCENT STREET, WESTMINSTER.

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MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the important results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

Fifty million cubic feet of gas per 24 hours are purified from ammonia by these Patent Scrubbers in a winter's day in the gas-works of London, where the purity of gas supply is the highest in the world, under the chemical restrictions of the Board of Trade.

Generally, wherever a high standard of purification is maintained in the chief cities and towns of the British Provinces and of Europe, these Scrubbers have become established.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, requiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. and W. Walker, 8, Finsbury Circus, London, E.C., or to Mr. William Mann, late Superintendent of the Chartered Gas-Works, Blackfriars, London; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

LESMAHAGOW CANNEL COAL.

FERRAND DAVIES,
148, GRESHAM HOUSE, OLD BROAD STREET, LONDON, E.C.,
SOLE AGENT FOR
THOMAS BARR'S LESMAHAGOW MAIN CANNEL.

Quotation and Analysis forwarded on application.

E. & W. H. HALEY,

General Ironfounders and Makers
OF
CAST-IRON GAS AND WATER PIPES.
Sizes 1¼ to 15 inches.

LISTER HILLS FOUNDRY, BRADFORD, YORKSHIRE.

GAS PURIFICATION.

BAILES & HALLSWORTH,
CONTRACTORS FOR THE
PURIFICATION OF COAL GAS
BY THEIR
PATENT HYDRATED PEROXIDE OF IRON MATERIAL.

The Material is adapted specially for taking up sulphuretted hydrogen, and will simultaneously absorb any ammonia that may pass the scrubbers.

The spent oxide resulting from our Material is more valuable than that from natural oxide of iron, and manufacturing chemists buy it in preference.

The Material has now been in use during the past three years in most of the principal Gas-Works in Yorkshire and elsewhere.

It contains considerably less moisture than natural oxide of iron, and is much cheaper and more efficient as a purifying agent.

B. & H. are purchasers of Spent Oxide, or will take Spent in exchange for New Material.

FOR SAMPLES AND TERMS, ADDRESS—
BAILES & HALLSWORTH, COPPERAS WORKS, ARMLEY, LEEDS.

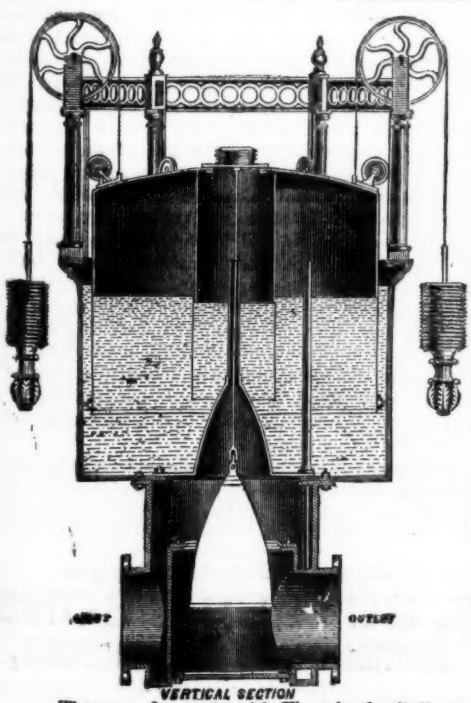
J. & J. BRADDOCK,

GLOBE METER-WORKS,
OLDHAM,

Beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,
173, ST. VINCENT STREET, GLASGOW.

SHOTT'S BOGHEAD.

LOTHIAN'S CANNEL
Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL
Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

OLD WEMYSS CANNEL
Yields 13,320 cubic feet of 32·5-candle gas per ton.
Prices and full Analyses on application.

GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over 10,000 cubic feet of gas, with an illuminating power of 16 candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

SCOTCH CANNEL COALS.

The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

JAMES M'KELVIE,
CANNEL COAL MERCHANT,
HAYMARKET, EDINBURGH.
Established 1840.

HEBBURN MAIN GAS COALS.

T. Stone, Esq., of Weymouth, writes on Nov. 17, 1876: "I have used about 12,000 tons of this Coal, with, I think, the best possible results, although not always under the most favourable circumstances. My Coal account made up to Midsummer last showed a makeage of 10,594 cubic feet per ton of 14½-candle gas, and not a hundredweight of Cannel used. This statement would, I know, be incredible to many men, and may provoke the remark, 'How much of it is paid for?' For the gratification of such, I have to say that, of the above quantity, 9866 cubic feet per ton of Coal carbonized were brought to charge and duly paid for, with the exception of about 6s. per cent. for bad debts. The coke is of excellent quality. The above facts I hold to be a greater recommendation to your Coal than any words of mine could be."

PRICES ON APPLICATION, EITHER F.O.B. OR BY RAIL IN TRUCK LOADS.

THE TYNE COAL COMPANY, LIMITED, OWNERS.
W. RICHARDSON, Fitter,
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ADDISON POTTER,
WILLINGTON QUAY,
NEAR NEWCASTLE-UPON-TYNE,
Manufacturer of
CLAY RETORTS, FIRE-BRICKS, AND EVERY DESCRIPTION OF FIRE-CLAY GOODS

CLOTH GAS-BAGS FOR MAINS.

As supplied to the Imperial, Chartered, and other London and Provincial Gas Companies. Bellows and Valves for inflating Well Dresses, Stokers' Gloves, India-Rubber Suction and Delivery Hose, Gas-Tubing, Leather, India-Rubber, and Gutta-Percha Machine-Bands, Sheet and Washers, and Steam Joints.

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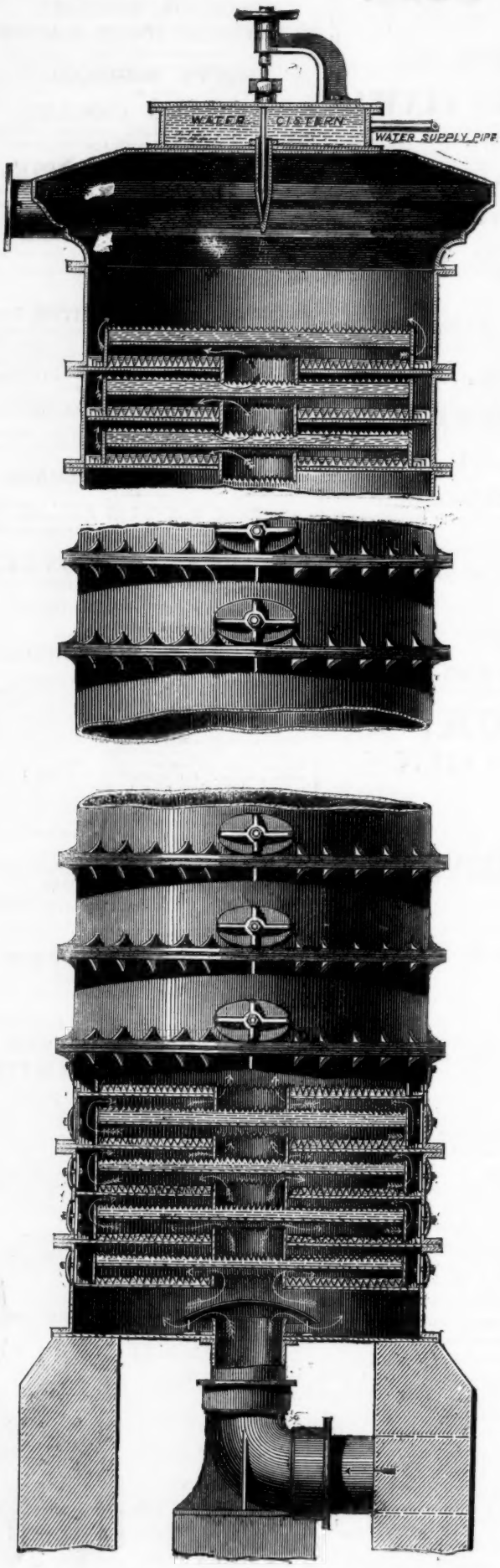
GRIRDROD'S PATENT
PORTABLE PIPE SCREWING MACHINE,

For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.

In use at the chief gas-works, and giving great satisfaction.

For other useful goods, see Bailey's "Illustrated Inventions," post free 3s. 6d.; gratis to ledger customers.

W. H. BAILEY & CO.,
Brassfounders, Gauge Injector and Tool Makers,
ALBION WORKS, SALFORD,
LANCASHIRE.



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CONTRACTORS FOR GAS & WATER WORKS,
GENERAL ENGINEERS, IRONFOUNDERS;
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MANUFACTURERS OF

Gasholders, Tanks, Purifiers,

SCRUBBERS, VALVES, EXHAUSTERS,

IRON ROOFS,

BRIDGES, BOILERS, AND GENERAL CAST AND WROUGHT IRON WORK.

S. C. & Sons undertake the entire Erection of New, or Remodelling of existing Gas-Works in any part of the World, including small Works for MANSIONS, FACTORIES, &c., or Works of the largest extent (are now constructing the largest Gasholder yet erected); also the Supplying and Laying of MAINS.

They make a speciality of supplying every requisite whatever for a Gas-Work, keeping in Stock what are most in request. WOOD SIEVES for Purifiers and Scrubbers, of a superior make.

SPECIAL CASTINGS to Drawing or Pattern at Shortest Notice.

MANUFACTURERS OF

CUTLER'S PATENT GAS-WASHER

AND

MORRIS & CUTLER'S PATENT CONDENSER.

(For Illustration and Description, see "Journal" for Jan. 8, page 70.)

DESCRIPTION OF CUTLER'S PATENT GAS-WASHER.

The Washer consists of a vessel or tower of a cylindrical or other form, convenient to the site available for it. The interior is fitted with a number of dished trays arranged as shown, one above the other, from bottom to top. The flanges or sides of these trays are formed with serrated edges, and are arranged so that each tray contains a certain depth of water or liquor; the position and size of the serrated orifices in the dipping edges being such that the upper parts are slightly above the water, and so that the combined area of these small orifices is proportionate to the size of the inlet-pipe, the gas passing through without increase of pressure, and diffused in thinly divided streams. All the other edges are likewise serrated, so that the liquor passes over same in small streams, and so that the gas cannot pass through in bulk. The water or washing liquor is admitted at the top, the supply being governed by a conical needle regulating-valve so that the amount can be regulated to any desired quantity. The gas is admitted at the bottom and out at the top, the water or liquor descending the one meeting the other, and thus being brought into the very closest contact, and the gas consequently being deprived of its ammonia and other impurities absorbed by water or other liquor.

Where a slight increase of pressure is not of great consequence, we prefer to allow some of the lower tiers of trays to be slightly sealed, the better to arrest any tar or heavy oils that may have passed the condenser.

For further Particulars, apply to

S. CUTLER & SONS,

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(NEAR THE STEAMBOAT PIER,)
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THE SILKSTONE & DODWORTH COAL & IRON COMPANY, LIMITED,

DODWORTH, BARNSLEY.

BENJAMIN WHITWORTH, Esq., M.P. . . . . Chairman.
Mr. RICHARD HARTLEY . . . . . Managing Director.

REAL OLD SILKSTONE GAS COAL.

JAMES PATERSON, Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.

HYDRATED PURIFYING MATERIAL.

Samples on application.

MESSRS. SPENCE BROS., LIMITED,

Will be glad to supply the above on the most favourable terms.

PRICES ON APPLICATION.

ALSO PATENT DRY COPPERAS FOR EXTRACTING AMMONIA.

VICTORIA CHEMICAL WORKS, BRADFORD, NEAR MANCHESTER.

Established

1795.

JOSEPH CLIFF & SONS,

THE ORIGINAL

WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS,

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LIVERPOOL: Back Leeds Street.

SPECIAL NOTICE.—Our Patent Machine-made Retorts have now been in *actual work* nearly 1000 days, and are yet in good order. References on application.
July 2, 1877.

NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD.

CELEBRATED SILKSTONE GAS COALS.

The various descriptions of Gas Coal produced from the above Collieries possess an unequalled reputation, combining in a large degree the constituents essential for the production of the best quality of Coke and Gas of a high illuminating power.

A recent extensive development of the Collieries enables us to offer increased supplies.

JAS. PATERSON, Esq., of Warrington, after testing various qualities of our Coal, has sent the following testimony of their merits:—

"Warrington Gaslight and Coke Company,
Offices, Mersey Street, Warrington, April 23, 1877.

"MESSRS. NEWTON, CHAMBERS, AND CO.,

"GENTLEMEN,—After carefully testing the various samples of Gas Coals sent from your Collieries for analysis, I have pleasure in reporting them as belonging to the highest class of Gas and Coking Coals.

"The average of Nine samples gives a yield of **12,500** cubic feet of **15½**-Candle Gas, being equivalent to **664** lbs. of sperm per ton, and **1420** lbs. of fixed carbon of a very superior quality. All the samples bear a close relation to each other in value.

"Yours truly, "JAMES PATERSON."

Full particulars will be sent on application to us—address as above.

CROLL'S
DRY GAS-METERS,

PRIZE MEDALS.
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(INVENTED & PATENTED IN 1844,)

COMBINING ALL THE LATEST IMPROVEMENTS,

MANUFACTURED ONLY BY

PRIZE MEDALS.
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MR. A. VERNON HARCOURT'S COLOUR TESTS,

FOR BISULPHIDE OF CARBON, SULPHURETTED HYDROGEN, AND CARBONIC ACID IN COAL GAS.

The demand for these instruments since A. Wright and Co. have had the manufacture and sale in their hands, has been so great as to necessitate their production in the same form generally as that of the model furnished to them; but improvements, which some time since received the approval of Mr. Harcourt, have been made, which render the apparatus more compact and convenient in several respects. The new form will also, when required, be made, *at extra cost*, with platinum instead of with glass bulbs. Drawings and particulars will be shortly ready. In the meantime, the instrument sent out will be as described in Mr. Harcourt's instructions, a copy of which will be sent per post on receipt of 2d. in stamps.

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GAS-METER AND APPARATUS MANUFACTURERS,
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F. W. HARTLEY, Manager.

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CONSUMERS IMPROVED WET GAS-METERS,
THE UNVARYING WATER-LINE GAS-METERS,
IMPROVED DRY GAS-METERS, in Cast-Iron or Tin-Plate Cases;
STATION-METERS, ALL SIZES, up to 15 feet Square, with PLANED JOINTS;
Experimental Meters, Photometers, Pressure-Gauges,
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Effecting an IMMENSE SAVING in the cost of discharging Coals from Vessels, Barges, &c.

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